U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
PB80-148562

Evaluation of Two Turbocharged Diesel Volkswagen Rabbits

(U.S.) Environmental Protection Agency, Ann Arbor, MI

Oct 79

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.: EPA-AA-TAEB-80-4	2.
4. TITLE AND SUBTITLE: Evaluation of two turbocharged Diesel Volkswagen Rabbits	5. REPORT DATE: October 1979
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S): Barth, Edward A. /Kranig, James M.	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Same as Box # 12	10. PROGRAM ELEMENT NO.
	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS: Technology Assessment & Evaluation Branch Emission Control Technology Division Office of Mobile Source Air Pollution Control U.S. Environmental Protection Agency Ann Arbor, MI 48105	13. TYPE OF REPORT AND PERIOD COVERED: Technical
	14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES	

16. ABSTRACT

The EPA was requested to test two Volkswagen Rabbits with turbocharged Diesel engines by the U.S. Department of Transportation. These were research vehicles which coupled turbochargers to small displacement Diesel engines with the objective of maintaining the fuel efficiency of the Diesel with a power output similiar to that of equal displacement gasoline engines. The DOT requested testing by the EPA as the EPA has the capability to assess the vehicle performance and emission levels. There has been limited experience in testing turbocharged Diesel engines. A small displacement Diesel with a matched turbocharger were to be evaluated by the EPA in terms of performance, fuel economy, particulate emissions, and gaseous emissions. These vehicles offered the opportunity of evaluating an automotive engine which may indicate the direction the auto industry will take in the future in an effort to minimize harmful emissions, maximize fuel economy and maintain current vehicle performance. This test program was run during the period of February 1977 to May 1978.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Volkswagen Rabbits Turbomachinery Diesel engines Fuel consumption Emission	Turbocharging	

18. DISTRIBUTION STATEMENT: UNLIMITED	19. SECURITY CLASS (This Report): UNCLASSIFIED	21. NO. OF PAGES
	20. SECURITY CLASS (This Page): UNCLASSIFIED	22. PRICE

EPA Form 2220-1 (9-73)

PB80-148562

EPA-AA-TAEB-80-4

Evaluation of Two Turbocharged Diesel Volkswagen Rabbits

October, 1979

Technology Assessment and Evaluation Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
Environmental Protection Agency

by

Edward A. Barth
James M. Kranig

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

Background

The Environmental Protection Agency (EPA) was requested to test two Volkswagen Rabbits with turbocharged Diesel engines by the U.S. Department of Transportation (DOT). These were research vehicles which coupled turbochargers to small displacement Diesel engines with the objective of maintaining the fuel efficiency of the Diesel with a power output similar to that of equal displacement gasoline engines. The DOT requested testing by the EPA as the EPA has the capability to assess the vehicle performance and emission levels.

There has been limited experience in testing turbocharged Diesel engines. These vehicles were particularly significant as it was the first time a small displacement Diesel with a matched turbocharger could be evaluated by the EPA in terms of performance, fuel economy, particulate emissions, and gaseous emissions. These vehicles offered the opportunity of evaluating an automotive engine which may indicate the direction the auto industry will take in the future in an effort to minimize harmful emissions, maximize fuel economy, and maintain current vehicle performance. This test program was run during the period of February 1977 to May 1978.

The conclusions from the EPA evaluation test can be considered to be quantitatively valid only for the specific test vehicles used. However, it is reasonable to extrapolate the results from the EPA test to other similar types of vehicles in a directional manner, i.e., to suggest that similar results are likely to be achieved on other similar types of vehicles.

Test Vehicles

The test vehicles were turbocharged Diesel Volkswagen Rabbits. The Volkswagen Rabbit Research Prototype Vehicle (RPV) was basically a standard production Rabbit Diesel modified through the addition of a turbocharger (see Table I). The power was transmitted through a four-speed manual transmission with an overall final drive ratio of 3.37:1.

In contrast, the Integrated Research Volkswagen (IRVW) was significantly different from a standard production Rabbit Diesel (see Table II). The engine was similar to that used in the RPV and was coupled to a five-speed manual transmission with an overall final drive ratio of 2.78:1. The structure of the IRVW was extensively changed from the production Rabbit to provide additional crashworthiness. However, the inertia weight of 2250 pounds remained unchanged from that of the production Rabbit.

Table I

TEST VEHICLE DESCRIPTION

Chassis model year/make - Volkswagen Rabbit Research Prototype Vehicle
Emission control system - Turbocharged Diesel

Engine

type	4 stroke, Diesel, in line 4 cyl, OHC
bore x stroke	76.5 x 80.0 mm/3.012 x 3.149 in.
displacement	1474.8 cc/90.0 cu. in.
compression ratio	23.5:1
maximum power at rpm	68 HP DIN at 5000 rpm
fuel metering	Bosch Fuel Injection
fuel requirement	Diesel Fuel No. 2

Drive Train

transmission type	4 speed manual
1st gear	3.46:1
2nd gear	1.94:1
3rd gear	1.29:1
4th gear	.97:1
axle ratio	3.48:1
overall gear ratio, 4th gear	3.37:1

Chassis

type	Front Engine, Front Wheel Drive
tire size	Semperit 155SR13, Rayon, Steel
curb weight	1985 lbs/900 kg.
inertia weight	2250 lbs
passenger capacity	4

Emission Control System

basic type	fuel injection, Garrett T-3 turbocharger, swirl chamber
durability accumulated on system	5200 miles/9360 km.

Table II

TEST VEHICLE DESCRIPTION

Chassis model year/make - Volkswagen IRVW Safety Vehicle
Emission control system - Turbocharged Diesel

Engine

type	4 stroke, Diesel, in line 4 cyl, OHC
bore x stroke	76.5 x 80.0 mm/3.012 x 3.149 in.
displacement	1474.8 cc/90.0 cu. in.
compression ratio	23.5:1
maximum power at rpm	70 hp DIN at 5000
fuel metering	Bosch Fuel Injection
fuel requirement	Diesel Fuel No. 2

Drive Train

transmission type	5 speed manual
final drive ratio	1st gear - 3.46:1 2nd gear - 1.94:1 3rd gear - 1.29:1 4th gear - .97:1 5th gear - .75:1
axle ratio	3.70
overall gear ratio (5th gear)	2.78

Chassis

type	Front Engine, Front Wheel Drive
tire size	175/70 SR13
curb weight	937 kg/2065 lbs.
inertia weight	2250 lb.
passenger capacity	4

Emission Control System

basic type	fuel injection, Garret T-3 turbocharger, swirl chamber
durability accumulated on system	1910 miles/3074 km.

Summary of Findings

- Both the RPV and the IRVW were well within the Federal Emission Standards for 1978 Light-Duty Diesel Vehicles.

- Increasing the shift speeds on the RPV caused an increase in CO and NOx emissions and a decrease in fuel economy for the FTP and HFET cycles. The effect on HC emissions was mixed.

- Higher inertia weights for the RPV resulted in either small or no decreases in HC and CO emissions. NOx emissions increased with increasing inertia weight and fuel economy decreased.

- The IRVW showed higher HC levels for the lower speed shift schedules for the FTP and HFET but lower levels for the LA-4 (a hot start FTP with no 10 minute soak and no bag 3 - the Federal Urban Dynamometer driving cycle).

- The IRVW yielded higher NOx levels for lower speed shift schedules for all test cycles when compared with the standard shift schedule results.

- The effect of variations in shift schedules on the IRVW levels of CO were mixed.

- For the IRVW, lower shift speeds tended to result in higher fuel economy.

- The various tires tested yielded equivalent results for the FTP except for a slight improvement in fuel economy when using the prepared Continentals. For the HFET, the Semperits and the prepared Continentals yielded equivalent or slightly lower HC and CO emissions than the stock Continentals and the prepared Continentals yielded slightly higher fuel economy levels.

- The IRVW was found to be within the proposed particulate standard of 0.2 grams per mile for 1983 Light-duty Diesel vehicles. Information on an applicable deterioration factor does not exist.

- Acceleration of both vehicles was adequate for normal driving.

Test Program

Exhaust emission and fuel economy tests were conducted in accordance with the 1978 Federal Test Procedure, Highway Fuel Economy Test Procedure, LA-4 Cycle Test Procedure, and Steady State Test Procedure. Particulate samples were collected during some of the FTP and HFET

cycles. Various shift schedules, inertia weights, and tires were used in the above tests. In addition, acceleration tests were conducted to evaluate the performance of the RPV Diesel. See Table III for the detailed listing of the tests conducted.

Discussion of Results

Research Prototype Vehicle Test Results

As received and tested at the standard inertia weight, the RPV yielded an average of 0.48, 0.93, and 0.96 grams per mile for HC, CO, and NOx, respectively, while attaining an average fuel economy level of 45.9 miles per gallon for the FTP. This is well within the Federal Emission Standards of 1.5, 15, and 2.0 grams per mile for 1978 Light-Duty Diesel Vehicles. In addition, the RPV conformed to these standards for each FTP test. The summaries of results are displayed in Figures 1 through 20 and are tabulated in Tables IV through IX. The individual test results are detailed in the Appendix.

RPV - Effects of Unscheduled Maintenance

An additional variable was introduced when the vehicle testing was interrupted by DOT to allow demonstration of the vehicle. The vehicle accumulated 2000 miles during these demonstrations. When it was returned, some testing was done before it was noticed that the vehicle demonstrated a transient smoke problem upon acceleration which had not been apparent previously. The vehicle was returned to Volkswagen for correction of the problem and the corrective action entailed reconditioning the injector nozzles. After its return, the smoke problem was gone but the test results appeared to be significantly different from those originally obtained. Therefore, the test results have been divided into three groups - Phase I was the initial testing, Phase II was the testing during the smoke problem period, and Phase III was the final testing. All three groups of data are presented in the Appendix but the summary plots and tables deal only with Phase I and Phase III testing.

In the FTP, HC emission levels were lower for Phase III than for Phase I. The CO levels were higher and NOx levels were substantially higher for Phase III. Fuel economy results were mixed but they appear to be about the same for each phase (see Figures 1-4).

HC, CO, and NOx levels for Phase III were much higher than for Phase I for the HFET cycle. The fuel economy for Phase III was lower than for Phase I (see Figures 5-8).

In contrast, the HC levels for the LA-4 cycle were lower for Phase III. CO and fuel economy were unaffected. NOx levels were higher for Phase III (see Figures 9-12).

Table III

Test Program

Research Prototype Vehicle

	Inertia Weight (lbs)	Shift Schedule
FTP	2250	Standard (15,25,40)
		18/30/47
		18/33/47
	2750	Standard
	3000	Standard
HFET	2250	Standard
		18/30/47
		18/33/47
	2750	Standard
	3000	Standard
LA-4	2250	Standard
	2750	Standard
	3000	Standard
Steady State	2250	Idle, 1st at 15
		2nd at 30, 3rd at 30, 4th at 30
		4th at 45, 4th at 60
	2750	Idle, 1st at 15, 2nd at 15
		2nd at 30 mph
		3rd at 30 mph
		4th at 30 mph
		4th at 45 mph
		4th at 60 mph
Acceleration		0-30
		0-40
		0-50
		0-60
		0-70

Integrated Research Volkswagen

	Inertia Weight (lbs)	Shift Schedule	Tires
FTP	2250	9/20/30/40	Continental
			Semperit
		11/21/32/42 (std.)	Continental
			Continental (lightly prepared)
		13/24/35/46	Continental

Table III (cont.)

Integrated Research Volkswagen

	Intertia Weight (lbs)	Shift Schedule	Tires
HFET	2250	9/20/30/40	Continental Semperit
		11/21/32/42	Continental Continental (lightly prepared)
		13/24/35/46	Continental (lightly prepared)
LA-4	2250	Standard	Continental
		9/20/30/40	Continental
		10/23/33/43	Continental
		11/21/32/42	Continental
Steady State	2250	idle, 1st at 15 2nd at 15 3rd at 30 3rd at 45 4th at 45 5th at 45 4th at 60 5th at 60	Continental
Sulfate	2250	Standard	Continental
Particulate-FTP	2250	Standard	Continental
Particulate-HFET	2250	Standard	Continental
Particulate-SS	2250	3rd at 30	Continental
Particulate-Sulfate	2250	Standard	Continental

For the Steady State cycle the effect on HC levels of the two Phases was mixed and depended upon the gear used and the speed. CO levels for Phase III were generally higher than those of Phase I. NOx levels were higher for Phase III. Fuel economy was lower for Phase III in every condition except for second gear at 30 mph and 2750 IW, where it was higher for Phase III (see Figures 13-16).

RPV - Effect of Varying Shift Schedule

The RPV was tested using three shift schedules which included the standard of 15/25/40 mph, as well as 18/30/47 mph, and 18/33/47 mph. For the FTP, the higher shift schedules caused HC emissions to either remain unchanged or to increase slightly. CO and NOx emissions increased and fuel economy decreased when the higher shift schedules were used (see Figures 1-4).

The higher shift schedules used for the HFET cycle did not cause any change in the levels of HC emissions. CO emission levels showed small increases as shift speeds were increased. NOx levels were found to increase while the fuel economy dropped when using the higher shift schedules (see Figures 5-8).

The HC emission levels and fuel economy dropped when the higher shift schedules were used for the LA-4 cycle. In contrast, CO and NOx emission levels showed large increases (see Figures 9-12).

RPV - Effect of Varying Inertia Weight

The RPV was also tested at three inertia weights (2250 lbs. - standard, 2750 lbs., and 3000 lbs.) because the vehicle demonstrated sufficient power to make its engine suitable for application to heavier vehicles. For the FTP cycle, the lower inertia weights gave better fuel economy, higher HC and CO emissions, and lower NOx emissions than the higher inertia weights.

For the HFET cycle the fuel economy was best at the lower inertia weights, HC emission levels decreased as the inertia weight was increased from 2250 lbs. to 2750 lbs. then increased as the inertia weight was increased to 3000 lbs. The CO emissions did not change significantly as the inertia weight was increased to 2750 lbs. but did increase as the inertia weight was increased to 3000 lbs. NOx emission levels increased and fuel economy decreased as the inertia weight was increased (see Figures 5-8).

HC emission levels tended to be higher for the lower inertia weights when tested by the LA-4 procedure. CO emissions showed a small decrease as the inertia weight was increased. NOx emissions tended to increase slightly as inertia weight was increased. Fuel economy tended to be better for the lower inertia weights (see Figures 9-12).

As vehicle inertia weight increases, higher dynamometer road load horsepower and dynamometer inertia weight values are used. However, inertia is not a factor in steady state tests. The steady state tests showed that the inertia weight increase, represented only by a higher road load horsepower had only a marginal effect. HC and NOx levels did not appear to change. CO emission levels and fuel economy were slightly lower for the higher inertia weight (see Figures 13-16).

RPV - Effects of Shift Schedule on Following Driving Schedule

The RPV was unable to maintain the desired acceleration rate to stay with the driver's trace on hard accelerations. The higher shift schedules improved the vehicle's acceleration capabilities. While the vehicle was tested using only the standard shift schedule at the higher inertia weights to minimize the number of tests required, it appeared that the vehicle could have maintained the prescribed acceleration rates at the higher inertia weights by using higher speed shifts.

RPV - General Summary of Results

The effect of the test conditions was not completely consistent when comparing the effect on each emission product or fuel economy among test types. However, increasing the shift speed tended to increase CO and NOx emissions and to decrease fuel economy. Its effect on HC ranged from an increase to a decrease depending upon the test cycle.

The lower inertia weights typically yielded higher or equal HC and CO emissions as well as better fuel economy than did the higher inertia weights. NOx emission levels, when using the lower inertia weights, were typically lower than or equal to the levels associated with the higher inertia weights.

The Phase III test results for CO emissions were generally higher or equal to the Phase I test results. NOx emissions were higher for Phase I than for Phase III. Fuel economy for the Phase III results tended to be less than or equal to the Phase I results. The effect of the Phases was mixed on HC over the various test cycles.

The RPV did meet the 1978 Federal Emission Standards for all FTP tests under each set of conditions. The highest single values recorded were 0.71, 1.32, and 1.76 grams per mile for HC, CO and NOx, respectively as compared with the standards of 1.5, 15, and 2.0 grams per mile.

The track acceleration test indicated that the RPV had adequate power for acceleration. Zero-to-50 mph times ranged from 10.5 to 11.1 seconds. This compares reasonably well with the advertised zero-to-50 mph time of 8.3 seconds for the 1979 gasoline powered Rabbit.

Integrated Research Volkswagen Test Results

The IRVW yielded average FTP results of 0.11, 0.57, and 0.92 grams per mile for HC, CO and NOx, respectively when tested at standard conditions. The resultant average fuel economy was 51.9 miles per gallon. This easily met the 1978 Light-Duty Diesel Vehicle Federal Emission Standards of 1.5, 15, and 2.0 grams per mile of HC, CO, and NOx, respectively. Each of the individual tests also met these standards.

IRVW - Effects of Varying Shift Schedule

The IRVW was tested at various shift schedules which included the standard schedule of 11/21/32/42 mph and other schedules of 9/20/30/40 mph, 10/23/33/43 mph, and 13/24/36/46 mph. For the FTP cycle the HC level was the same for the standard and higher shift schedules and was increased when the lower shift schedule was used. The CO and NOx was lowest when the 11/21/32/42 shift schedule was used. Fuel economy was not significantly affected by the shift schedule (see Figures 1-4).

For the HFET cycle the HC levels decreased as the shift speeds were increased. The HC levels were significantly higher when the lowest shift schedule was used. The CO and NOx levels were highest for the low shift speeds and lowest for the standard shift speeds. The highest shift speeds yielded results only slightly higher than the standard shift speeds. Fuel economy was comparable for the two lower speed shift schedule and was lower for the 13/24/32/42 mph shift schedule (see Figures 5-8).

HC levels in the LA-4 cycle were lowest for the 9/20/30/40 schedule and highest for the 10/23/33/43 schedule. CO levels were progressively higher as the shift speeds were increased. The lower speed shift schedules caused an increase of NOx levels compared with the 11/21/32/42 shift schedule. The fuel economy for the LA-4 tended to be slightly lower as the shift speed was increased (see Figures 9-12).

IRVW - Effects of Tires

The IRVW was tested with three types of tires for the FTP and HFET cycles. These included Continental Steel Belted Radials and lightly prepared Continentals which had some of the tread mechanically removed when they were trued on a machine. Also, the Semperit tires from the RPV were used (see Figures 1-8).

For the FTP cycle HC, CO and NOx emissions were not significantly affected by the changing of tires. The fuel economy obtained when using the prepared tires was slightly better than the others. For the HFET cycle the NOx levels were unaffected by changing tires. For the Continentals, HC and CO levels were the same or slightly higher than the

Semperits and the prepared Continentals for the HFET cycle. The Continentals resulted in the same fuel economy as the Semperits while the prepared Continentals yielded higher fuel economy. The LA-4 and steady state tests were conducted with the Continental tires only.

IRVW - General Summary of Results

The effect of the variables, shift schedules and tires, on fuel economy varied among test cycles. HC levels were highest for the 9/20/30/40 shift schedule while the 11/21/32/42 and 13/24/35/46 schedule gave comparable results to each other for the FTP. In contrast, the 9/20/30/40 schedule yielded the lowest HC levels for the LA-4 cycle. For the HFET cycles the HC levels tended to decrease as the shift speeds increased.

The low speed shift schedule resulted in the highest NOx levels for the FTP, HFET, and LA-4 with the 11/21/32/42 schedule yielding the lowest NOx levels. The CO results were mixed among the test cycles when the shift schedules were varied. The shift schedule effect on FTP fuel economy was a slight decrease as shift speeds increased. The lower shift speeds resulted in higher fuel economies for the HFET and LA-4.

The various tires had little, if any, effect on the FTP emissions results except that fuel economy was slightly improved with the prepared Continental tires. The tires either showed no significant differences or the Semperits and prepared Continentals gave slightly lower results for all of the HFET emission results. However, the prepared Continental tires gave better fuel economy for the HFET cycle.

The IRVW yielded average particulate emissions for the Urban Dynamometer Schedule of 0.18 grams per mile. The IRVW met the proposed 1983 particulate level (0.20 gm/mile) both on the average and in each individual test. It also demonstrated a reduction from the standard 1979 Certification Rabbit Diesel which yielded 0.23 grams per mile.

Conclusions

- Both vehicles met the 1978 Light-Duty Diesel Vehicle Federal Gaseous Emission Standards.
- The IRVW met the proposed particulate standard for 1983 vehicles.
- Both vehicles were somewhat sensitive to shift speed changes over a small range regarding gaseous emissions and fuel economy, but the degree of sensitivity and direction of change for each was dependent upon the test cycle.

- Fuel economy, HC emissions, and CO emissions generally dropped or remained unchanged as the inertia weight was increased and the NOx emissions generally increased or remained unchanged.

- Tires had little effect except for the prepared Continentals causing small increases in fuel economy, on the FTP and HFET cycles.

- Acceleration was adequate and the engine appeared to show a potential for application to larger vehicles.

Figure 1

FTP TEST RESULTS SUMMARY
HYDROCARBON
HC - MEAN VALUE (GRAMS PER MILE)
0
.2
.4
.6
.8
1.0
1.2
1.4
TEST CONDITIONS
RPV - 2250 - 15/23/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/30/47 - I
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 2750 - 15/25/40 - III
RPV - 3000 - 15/25/40 - I
RPV - 3000 - 15/25/40 - III
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 11/21/32/42 - Continental
IRVW - 2250 - 13/24/35/46 - Continental
IRVW - 2250 - 11/21/32/42 - Prepared Continental
IRVW - 2250 - 9/20/30/40 - Semperit

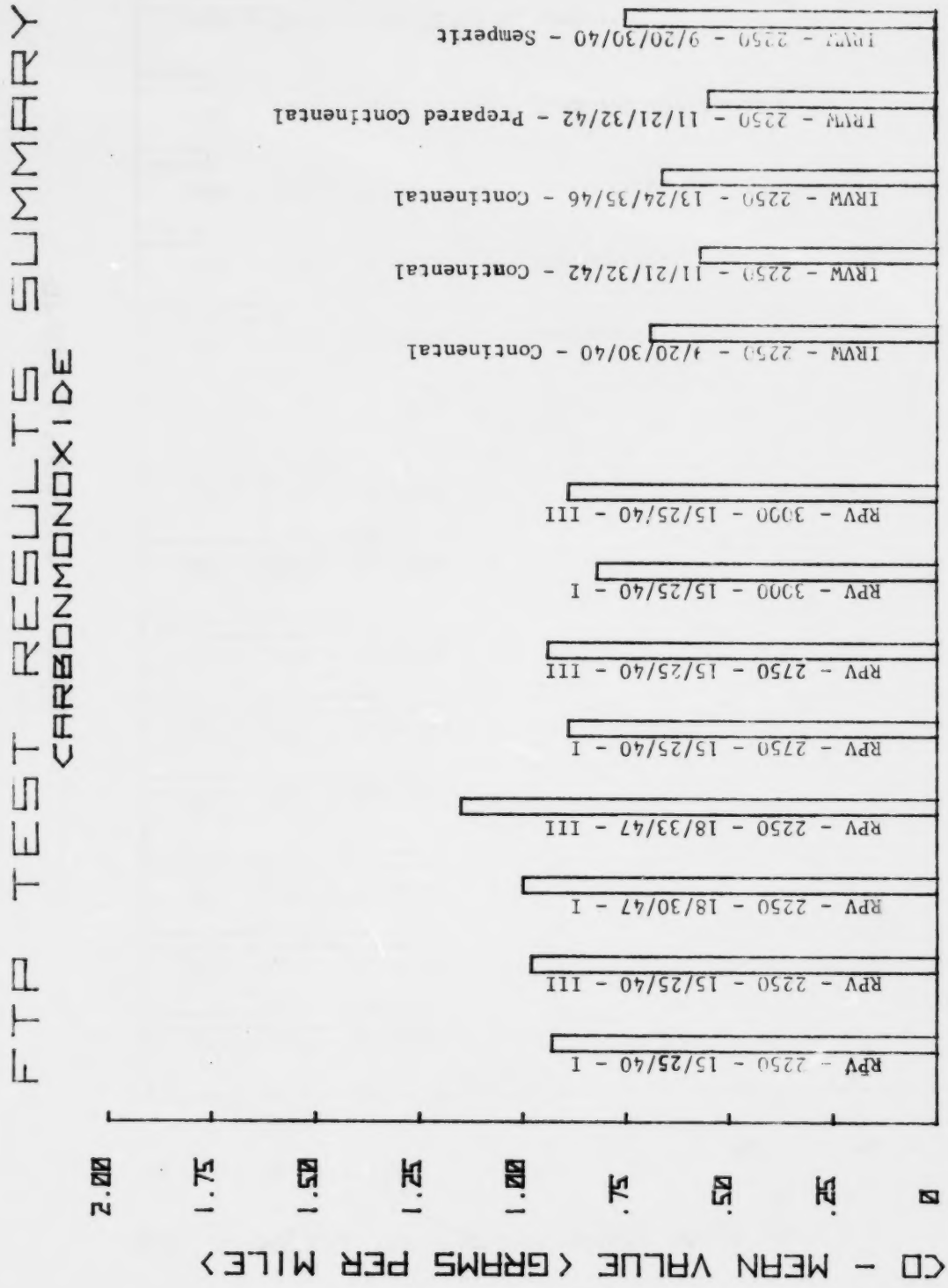
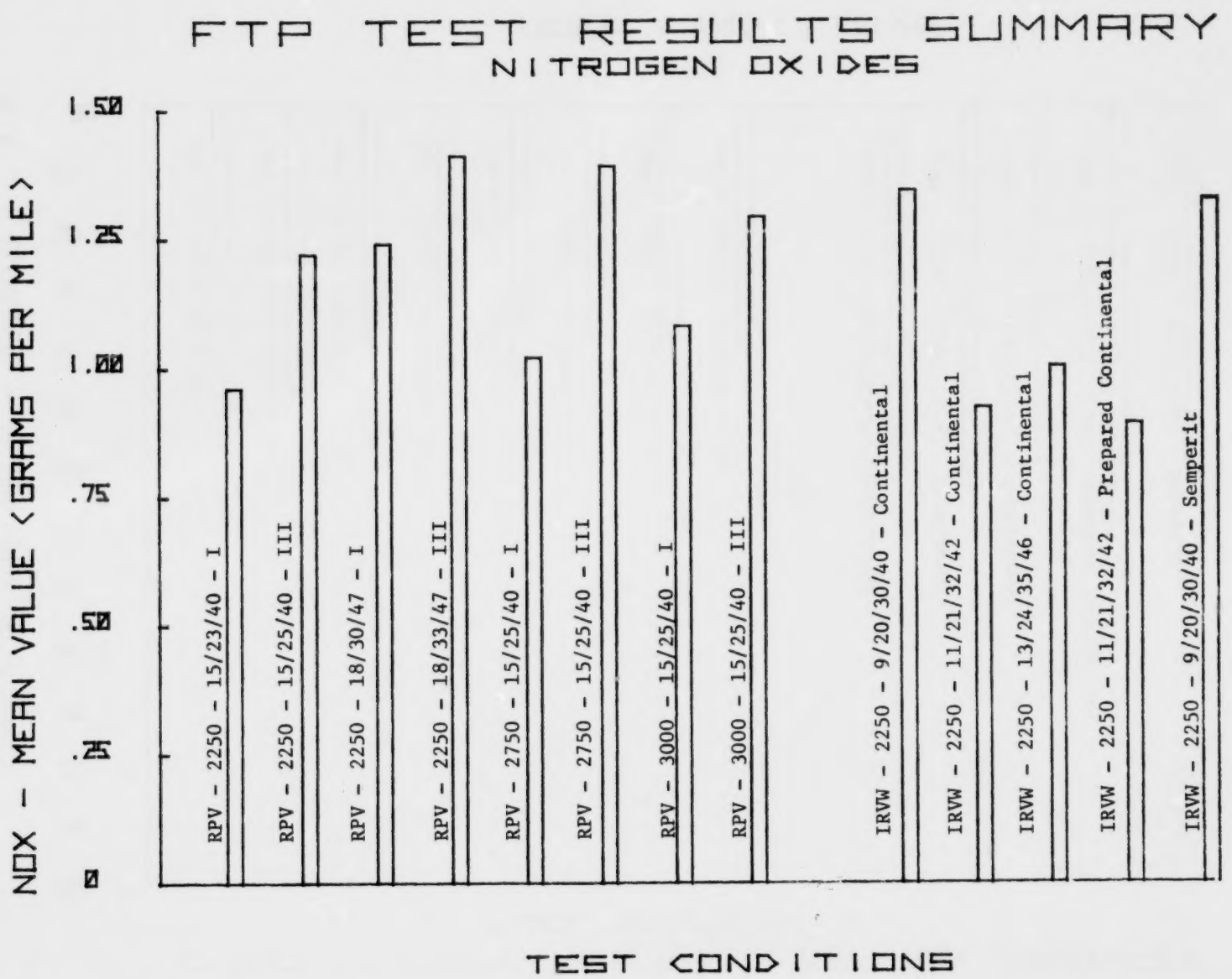

FTP TEST RESULTS SUMMARY
CARBONMONOXIDE
CO - MEAN VALUE (GRAMS PER MILE)
2.00
1.75
1.50
1.25
1.00
.75
.50
.25
0
TEST CONDITIONS
RPV - 2250 - 15/25/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/30/47 - I
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 2750 - 15/25/40 - III
RPV - 3000 - 15/25/40 - I
RPV - 3000 - 15/25/40 - III
IRVW - 2250 - 4/20/30/40 - Continental
IRVW - 2250 - 11/21/32/42 - Continental
IRVW - 2250 - 13/24/35/46 - Continental
IRVW - 2250 - 11/21/32/42 - Prepared Continental
IRVW - 2250 - 9/20/30/40 - Semperit

Figure 2

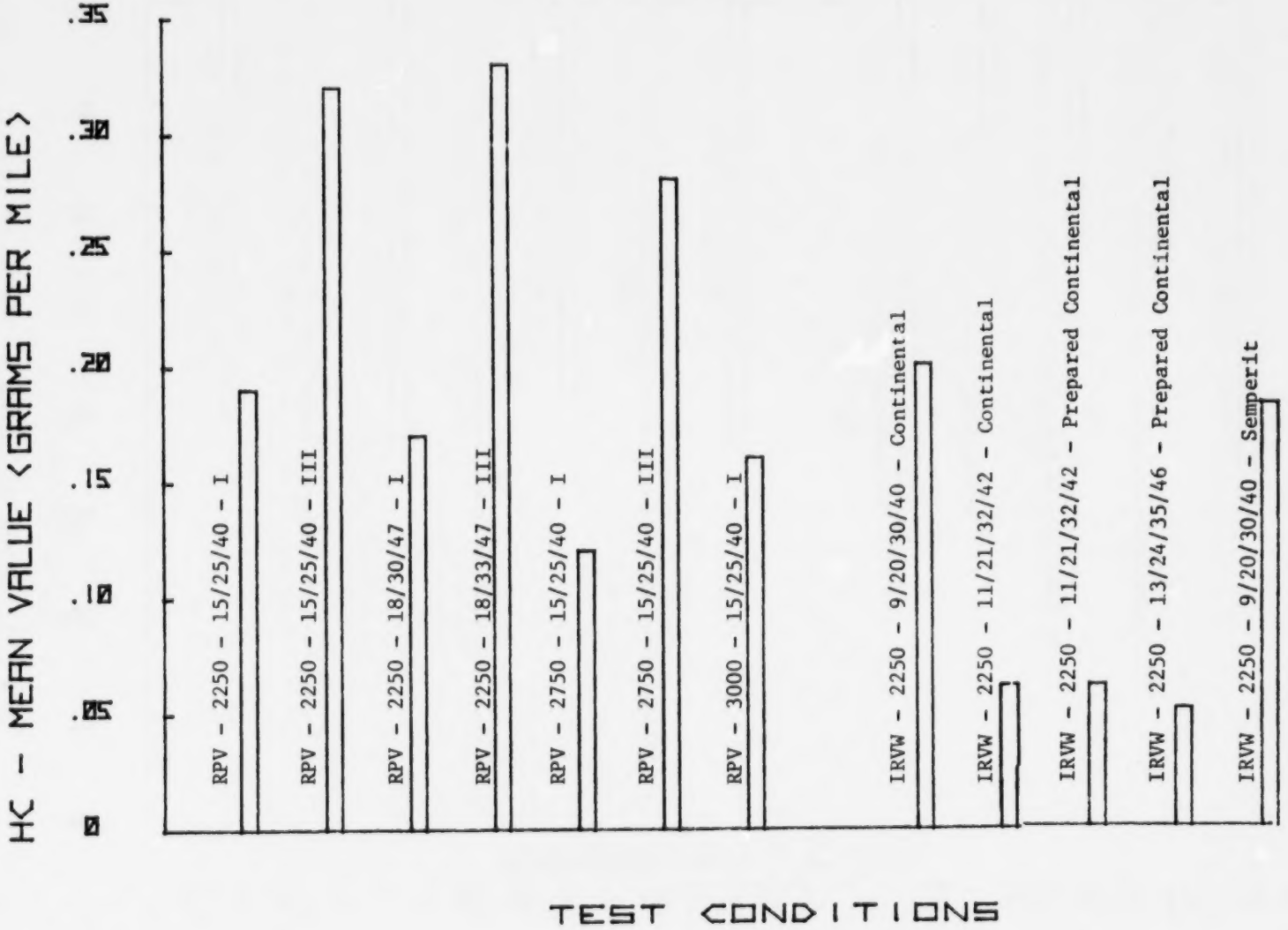
Figure 3


FTP TEST RESULTS SUMMARY
NITROGEN OXIDES
NOX - MEAN VALUE (GRAMS PER MILE)
0
.25
.50
.75
1.00
1.25
1.50
RPV - 2250 - 15/23/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/30/47 - I
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 2750 - 15/25/40 - III
RPV - 3000 - 15/25/40 - I
RPV - 3000 - 15/25/40 - III
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 11/21/32/42 - Continental
IRVW - 2250 - 13/24/35/46 - Continental
IRVW - 2250 - 11/21/32/42 - Prepared Continental
IRVW - 2250 - 9/20/30/40 - Semperit
TEST CONDITIONS

FTP TEST RESULTS SUMMARY
FUEL ECONOMY
FUEL ECONOMY - MEAN VALUE (MPG)
TEST CONDITIONS
RPV - 2250 - 15/23/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/30/47 - I
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 2750 - 15/25/40 - III
RPV - 3000 - 15/25/40 - I
RPV - 3000 - 15/25/40 - III
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 11/21/32/42 - Continental
IRVW - 2250 - 13/24/35/46 - Continental
IRVW - 2250 - 11/21/32/42 - Prepared Continental
IRVW - 2250 - 9/20/30/40 - Semperit

Figure 4

Figure 5


HFET TEST RESULTS SUMMARY
HYDROCARBON
HC - MEAN VALUE <GRAMS PER MILE>
0
.05
.10
.15
.20
.25
.30
.35
RPV - 2250 - 15/25/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/30/47 - I
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 2750 - 15/25/40 - III
RPV - 3000 - 15/25/40 - I
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 11/21/32/42 - Continental
IRVW - 2250 - 11/21/32/42 - Prepared Continental
IRVW - 2250 - 13/24/35/46 - Prepared Continental
IRVW - 2250 - 9/20/30/40 - Semperit
TEST CONDITIONS

HFET TEST RESULTS SUMMARY
CARBONMONOXIDE
CO - MEAN VALUE (GRAMS PER MILE)
0
.20
.40
.60
.80
TEST CONDITIONS
RPV - 2250 - 15/25/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/30/47 - I
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 2750 - 15/25/40 - III
RPV - 3000 - 15/25/40 - I
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 11/21/32/42 - Continental
IRVW - 2250 - 11/21/32/42 - Prepared Continental
IRVW - 2250 - 13/24/35/46 - Prepared Continental
IRVW - 2250 - 9/20/30/40 - Semperit

Figure 6

HFET TEST RESULTS SUMMARY
NITROGEN OXIDES
NOX - MEAN VALUE (GRAMS PER MILE)
0
.20
.40
.60
.80
1.00
1.20
1.40
TEST CONDITIONS
RPV - 2250 - 15/25/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/30/47 - I
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 2750 - 15/25/40 - III
RPV - 3000 - 15/25/40 - I
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 11/21/32/42 - Continental
IRVW - 2250 - 11/21/32/42 - Prepared Continental
IRVW - 2250 - 13/24/35/46 - Prepared Continental
IRVW - 2250 - 9/20/30/40 - Semperit

Figure 7

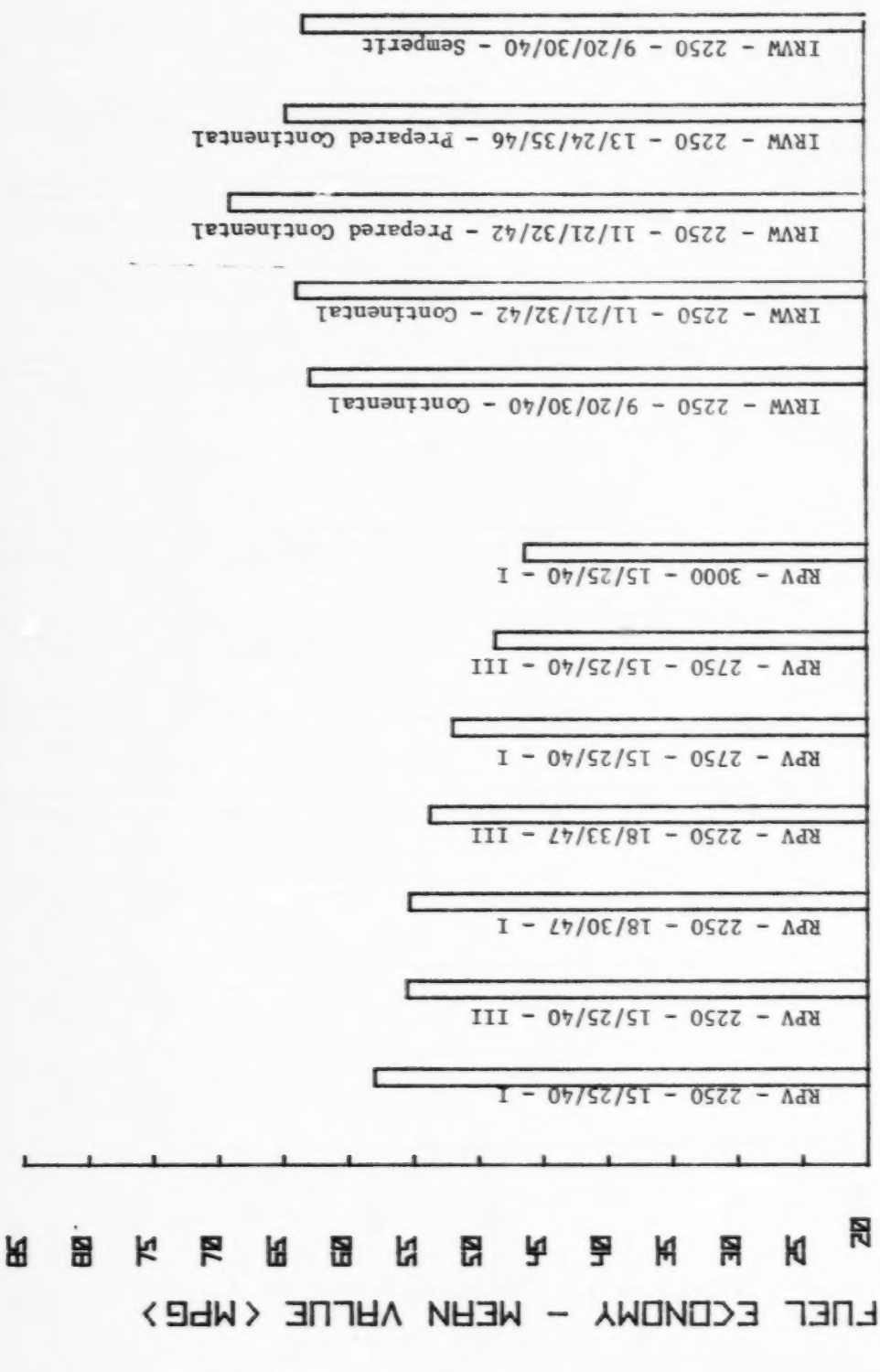

HFET TEST RESULTS SUMMARY
FUEL ECONOMY
FUEL ECONOMY - MEAN VALUE (MPG)
20
25
30
35
40
45
50
55
60
65
70
75
80
85
TEST CONDITIONS
RPV - 2250 - 15/25/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/30/47 - I
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 2750 - 15/25/40 - III
RPV - 3000 - 15/25/40 - I
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 11/21/32/42 - Continental
IRVW - 2250 - 11/21/32/42 - Prepared Continental
IRVW - 2250 - 13/24/35/46 - Prepared Continental
IRVW - 2250 - 9/20/30/40 - Semperit

Figure 8

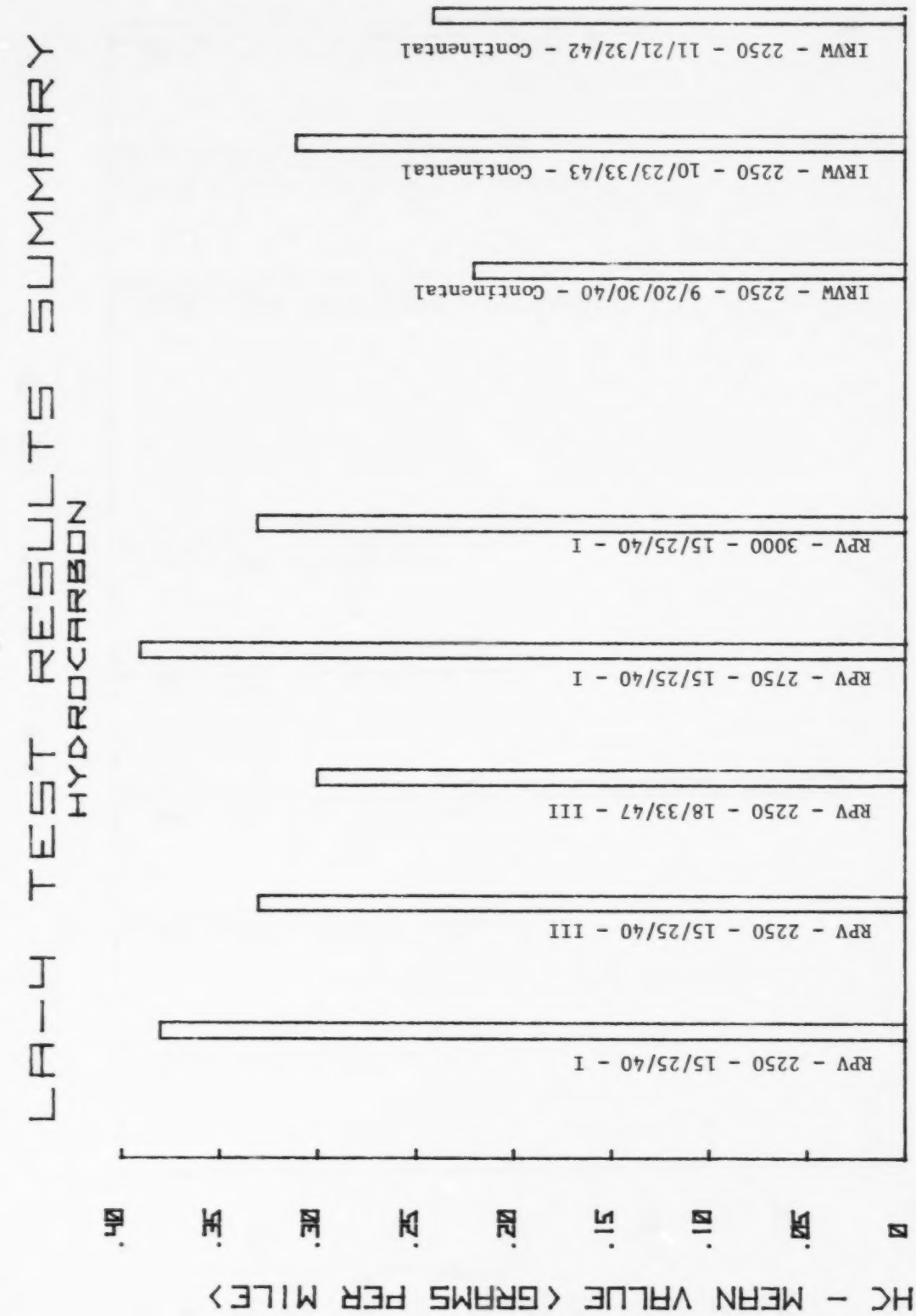

LA-4 TEST RESULTS SUMMARY
HYDROCARBON
HC - MEAN VALUE (GRAMS PER MILE)
0
.05
.10
.15
.20
.25
.30
.35
.40
TEST CONDITIONS
RPV - 2250 - 15/25/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 3000 - 15/25/40 - I
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 10/23/33/43 - Continental
IRVW - 2250 - 11/21/32/42 - Continental

Figure 9

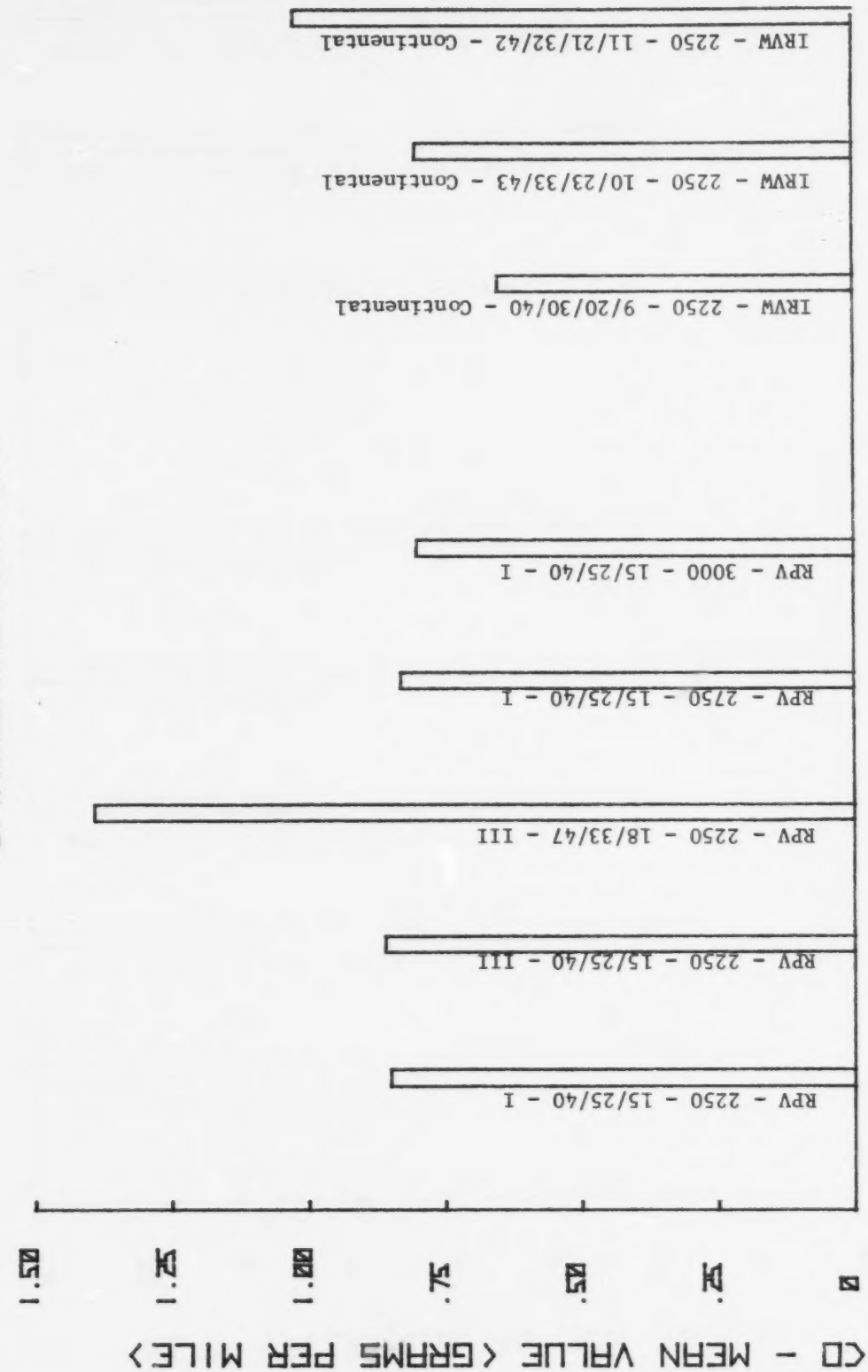

LA-4 TEST RESULTS SUMMARY
CARBONMONOXIDE
CO - MEAN VALUE (GRAMS PER MILE)
0
.25
.50
.75
1.00
1.25
1.50
TEST CONDITIONS
RPV - 2250 - 15/25/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 3000 - 15/25/40 - I
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 10/23/33/43 - Continental
IRVW - 2250 - 11/21/32/42 - Continental

Figure 10

Figure 11

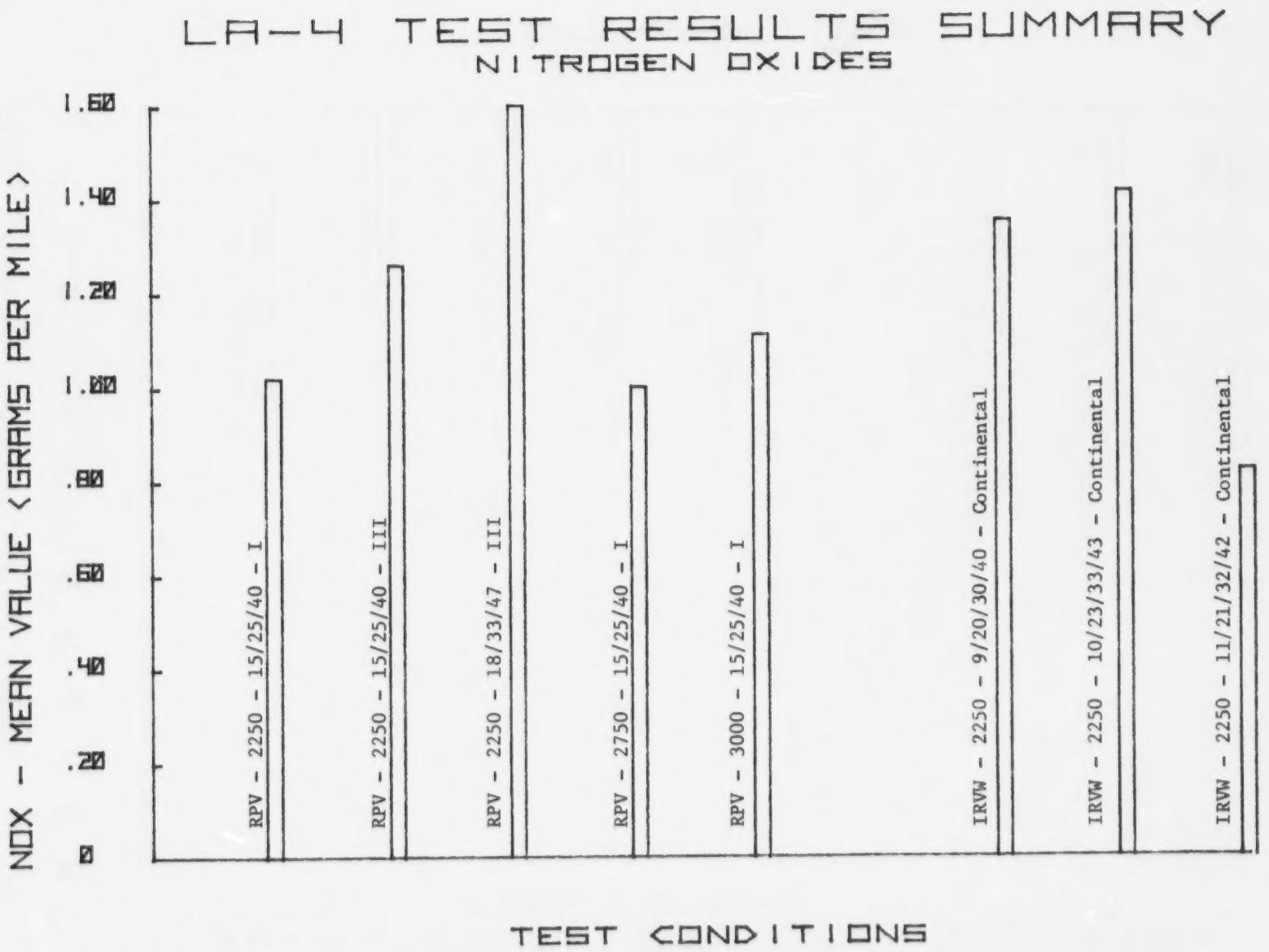
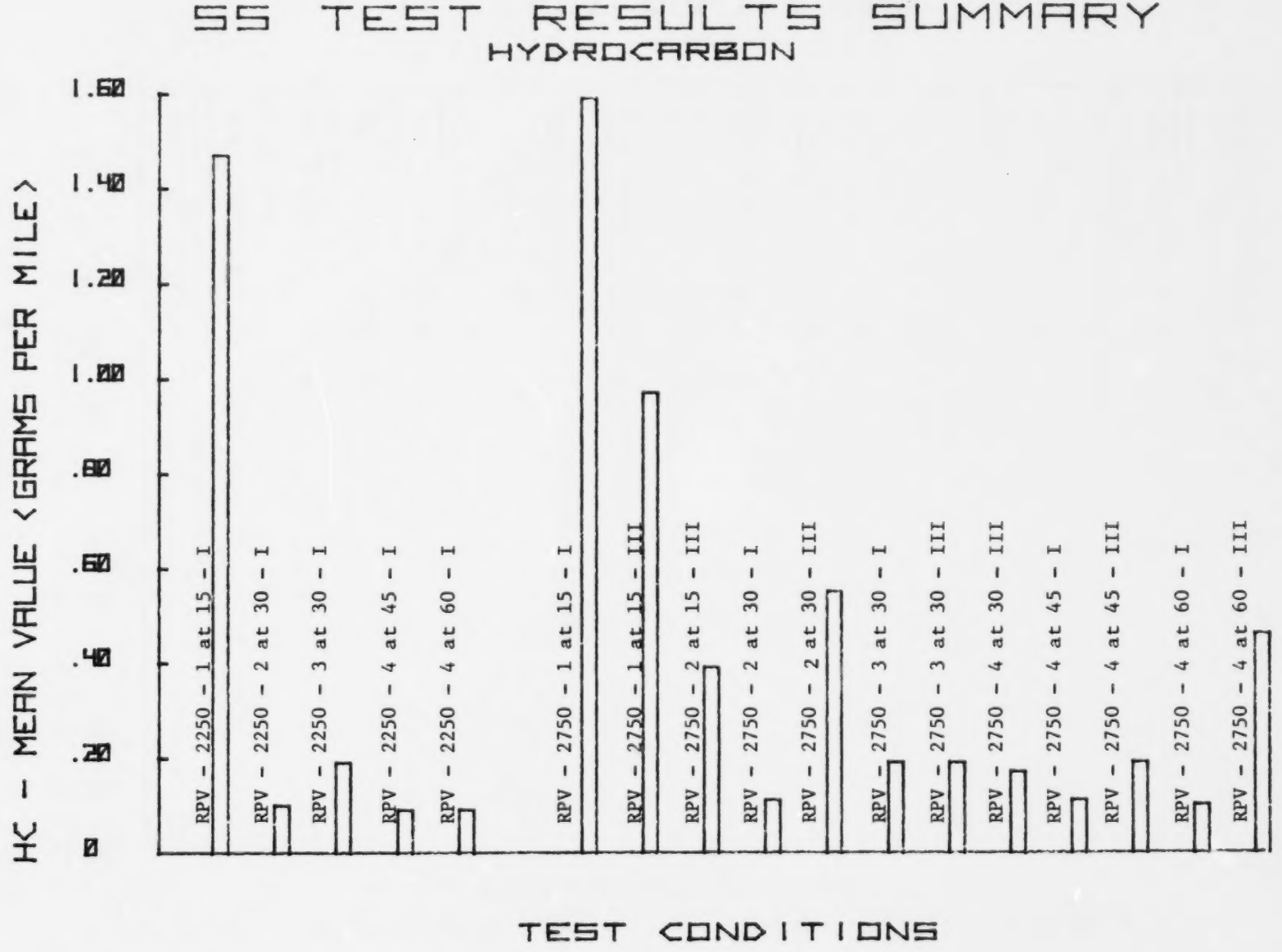

LA-4 TEST RESULTS SUMMARY
NITROGEN OXIDES
NOX - MEAN VALUE (GRAMS PER MILE)
0
.20
.40
.60
.80
1.00
1.20
1.40
1.60
RPV - 2250 - 15/25/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 3000 - 15/25/40 - I
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 10/23/33/43 - Continental
IRVW - 2250 - 11/21/32/42 - Continental
TEST CONDITIONS

Figure 12

LA-4 TEST RESULTS SUMMARY
FUEL ECONOMY
FUEL ECONOMY - MEAN VALUE (MPG)
20
TEST CONDITIONS
RPV - 2250 - 15/25/40 - I
RPV - 2250 - 15/25/40 - III
RPV - 2250 - 18/33/47 - III
RPV - 2750 - 15/25/40 - I
RPV - 3000 - 15/25/40 - I
IRVW - 2250 - 9/20/30/40 - Continental
IRVW - 2250 - 10/23/33/43 - Continental
IRVW - 2250 - 11/21/32/42 - Continental

Figure 13


55 TEST RESULTS SUMMARY
HYDROCARBON
HC - MEAN VALUE (GRAMS PER MILE)
0
.20
.40
.60
.80
1.00
1.20
1.40
1.60
RPV - 2250 - 1 at 15 - I
RPV - 2250 - 2 at 30 - I
RPV - 2250 - 3 at 30 - I
RPV - 2250 - 4 at 45 - I
RPV - 2250 - 4 at 60 - I
RPV - 2750 - 1 at 15 - I
RPV - 2750 - 1 at 15 - III
RPV - 2750 - 2 at 15 - III
RPV - 2750 - 2 at 30 - I
RPV - 2750 - 2 at 30 - III
RPV - 2750 - 3 at 30 - I
RPV - 2750 - 3 at 30 - III
RPV - 2750 - 4 at 30 - III
RPV - 2750 - 4 at 45 - I
RPV - 2750 - 4 at 45 - III
RPV - 2750 - 4 at 60 - I
RPV - 2750 - 4 at 60 - III
TEST CONDITIONS

SS TEST RESULTS SUMMARY
CARBONMONOXIDE
CO - MEAN VALUE (GRAMS PER MILE)
3.000
2.750
2.500
2.250
2.000
1.750
1.500
1.250
1.000
.750
.500
.250
0
TEST CONDITIONS
RPV - 2250 - 1 at 15 - I
RPV - 2250 - 2 at 30 - I
RPV - 2250 - 3 at 30 - I
RPV - 2250 - 4 at 45 - I
RPV - 2250 - 4 at 60 - I
RPV - 2750 - 1 at 15 - I
RPV - 2750 - 1 at 15 - III
RPV - 2750 - 2 at 15 - III
RPV - 2750 - 2 at 30 - I
RPV - 2750 - 2 at 30 - III
RPV - 2750 - 3 at 30 - I
RPV - 2750 - 3 at 30 - III
RPV - 2750 - 4 at 30 - III
RPV - 2750 - 4 at 45 - I
RPV - 2750 - 4 at 45 - III
RPV - 2750 - 4 at 60 - I
RPV - 2750 - 4 at 60 - III

Figure 14

SS TEST RESULTS SUMMARY
NITROGEN OXIDES
NOX - MEAN VALUE (GRAMS PER MILE)
0
.20
.40
.60
.80
1.00
1.20
1.40
1.60
1.80
2.00
2.20
2.40
2.60
2.80
TEST CONDITIONS
RPV - 2250 - 1 at 15 - I
RPV - 2250 - 2 at 30 - I
RPV - 2250 - 3 at 30 - I
RPV - 2250 - 4 at 45 - I
RPV - 2250 - 4 at 60 - I
RPV - 2750 - 1 at 15 - I
RPV - 2750 - 1 at 15 - III
RPV - 2750 - 2 at 15 - III
RPV - 2750 - 2 at 30 - I
RPV - 2750 - 2 at 30 - III
RPV - 2750 - 3 at 30 - I
RPV - 2750 - 3 at 30 - III
RPV - 2750 - 4 at 30 - III
RPV - 2750 - 4 at 45 - I
RPV - 2750 - 4 at 45 - III
RPV - 2750 - 4 at 60 - I
RPV - 2750 - 4 at 60 - III

Figure 15

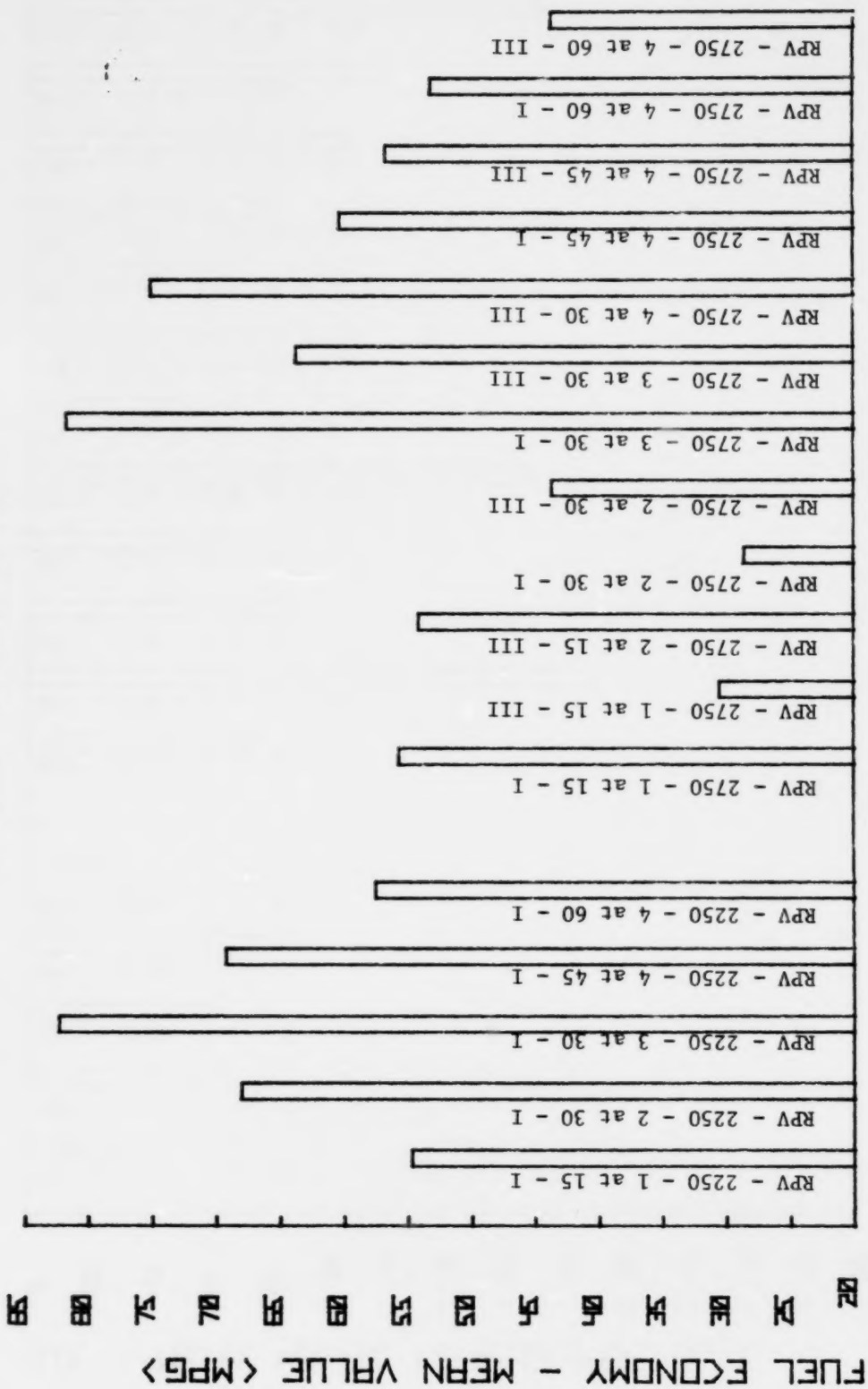
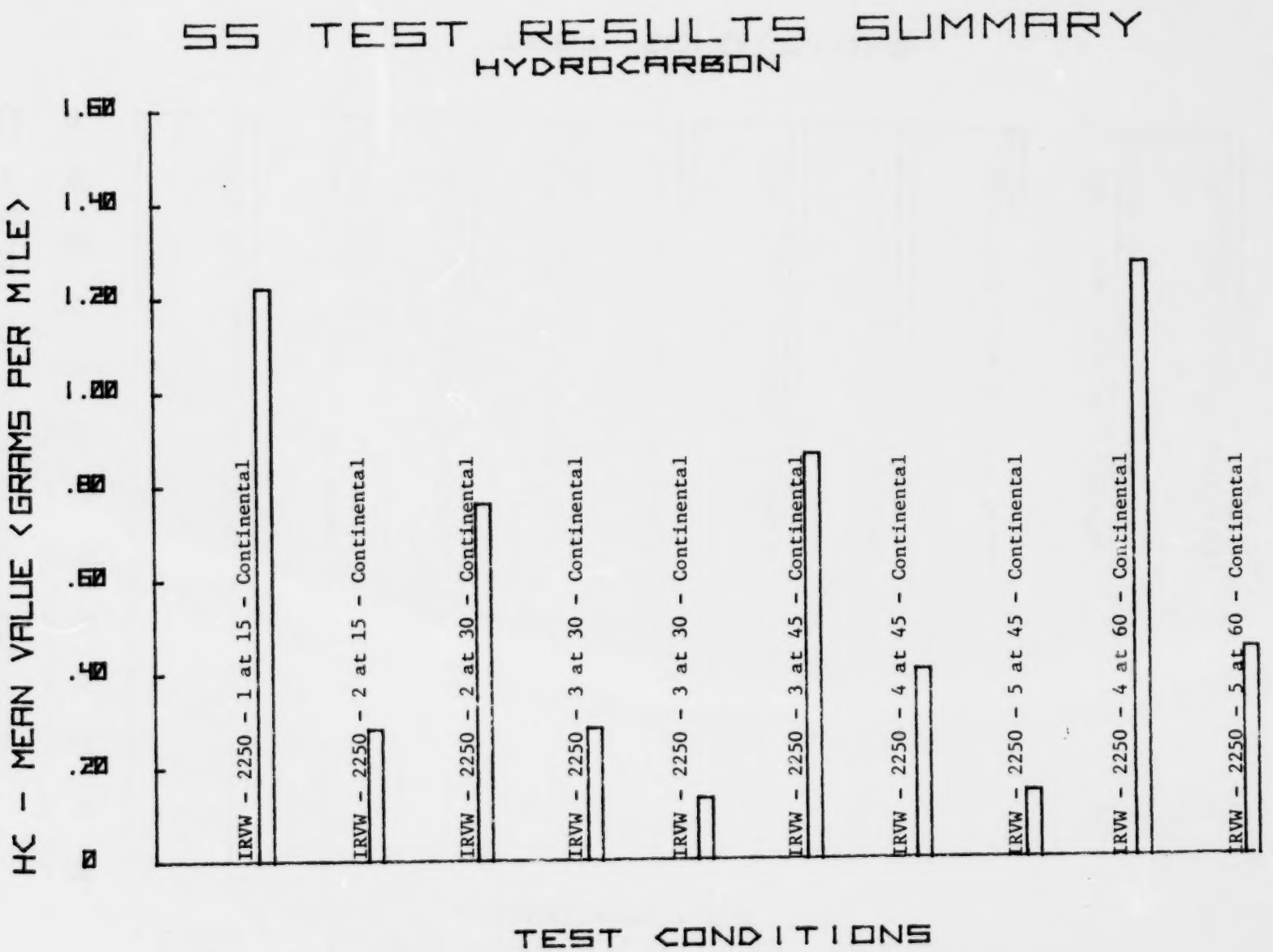

SS TEST RESULTS SUMMARY
FUEL ECONOMY
FUEL ECONOMY - MEAN VALUE (MPG)
20
22
24
26
28
30
32
34
36
38
TEST CONDITIONS
RPV - 2250 - 1 at 15 - I
RPV - 2250 - 2 at 30 - I
RPV - 2250 - 3 at 30 - I
RPV - 2250 - 4 at 45 - I
RPV - 2250 - 4 at 60 - I
RPV - 2750 - 1 at 15 - I
RPV - 2750 - 1 at 15 - III
RPV - 2750 - 2 at 15 - III
RPV - 2750 - 2 at 30 - I
RPV - 2750 - 2 at 30 - III
RPV - 2750 - 3 at 30 - I
RPV - 2750 - 3 at 30 - III
RPV - 2750 - 4 at 30 - III
RPV - 2750 - 4 at 45 - I
RPV - 2750 - 4 at 45 - III
RPV - 2750 - 4 at 60 - I
RPV - 2750 - 4 at 60 - III

Figure 16

Figure 17


55 TEST RESULTS SUMMARY
HYDROCARBON
HC - MEAN VALUE <GRAMS PER MILE>
0
.20
.40
.60
.80
1.00
1.20
1.40
1.60
IRVW - 2250 - 1 at 15 - Continental
IRVW - 2250 - 2 at 15 - Continental
IRVW - 2250 - 2 at 30 - Continental
IRVW - 2250 - 3 at 30 - Continental
IRVW - 2250 - 3 at 30 - Continental
IRVW - 2250 - 3 at 45 - Continental
IRVW - 2250 - 4 at 45 - Continental
IRVW - 2250 - 5 at 45 - Continental
IRVW - 2250 - 4 at 60 - Continental
IRVW - 2250 - 5 at 60 - Continental
TEST CONDITIONS

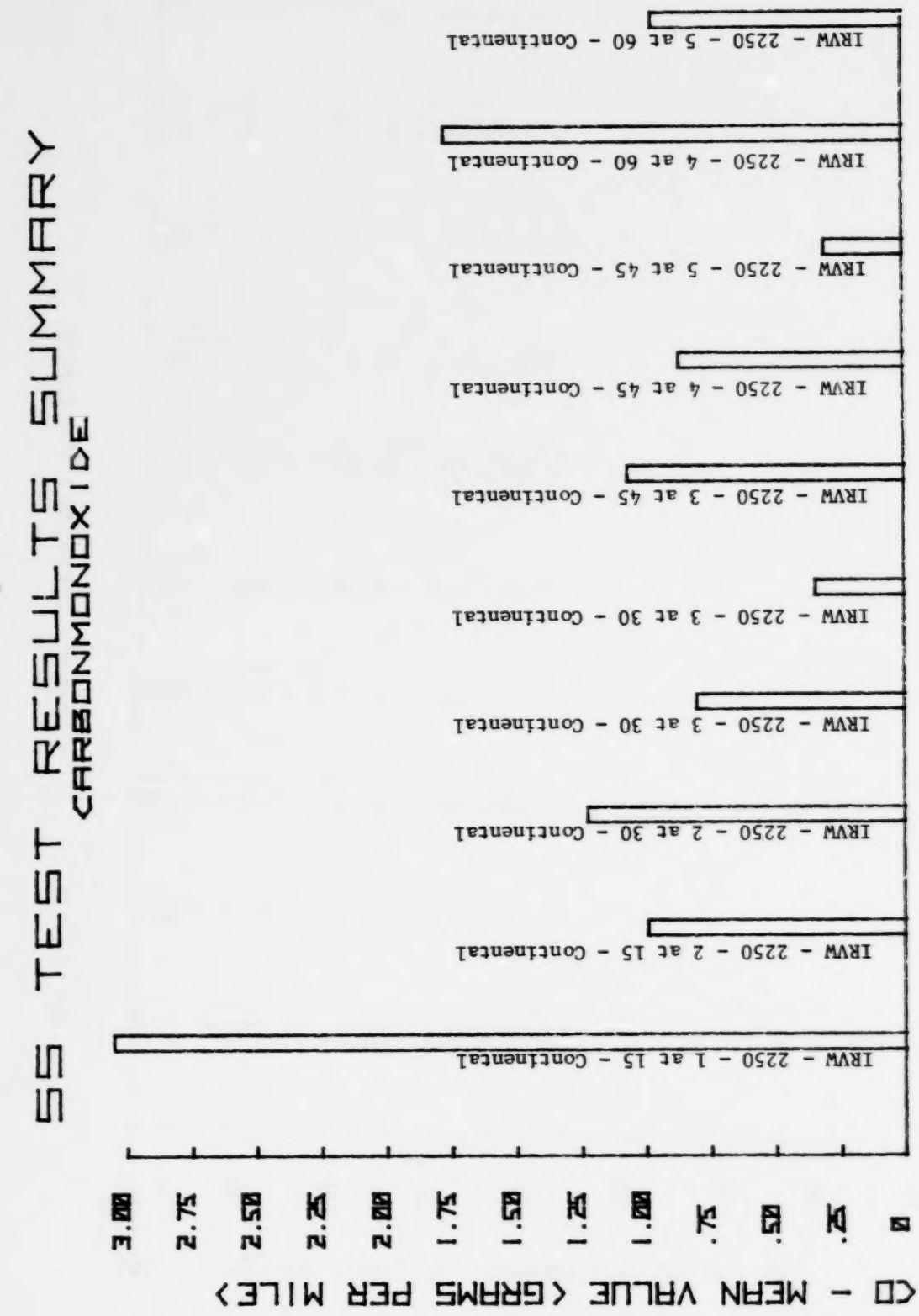
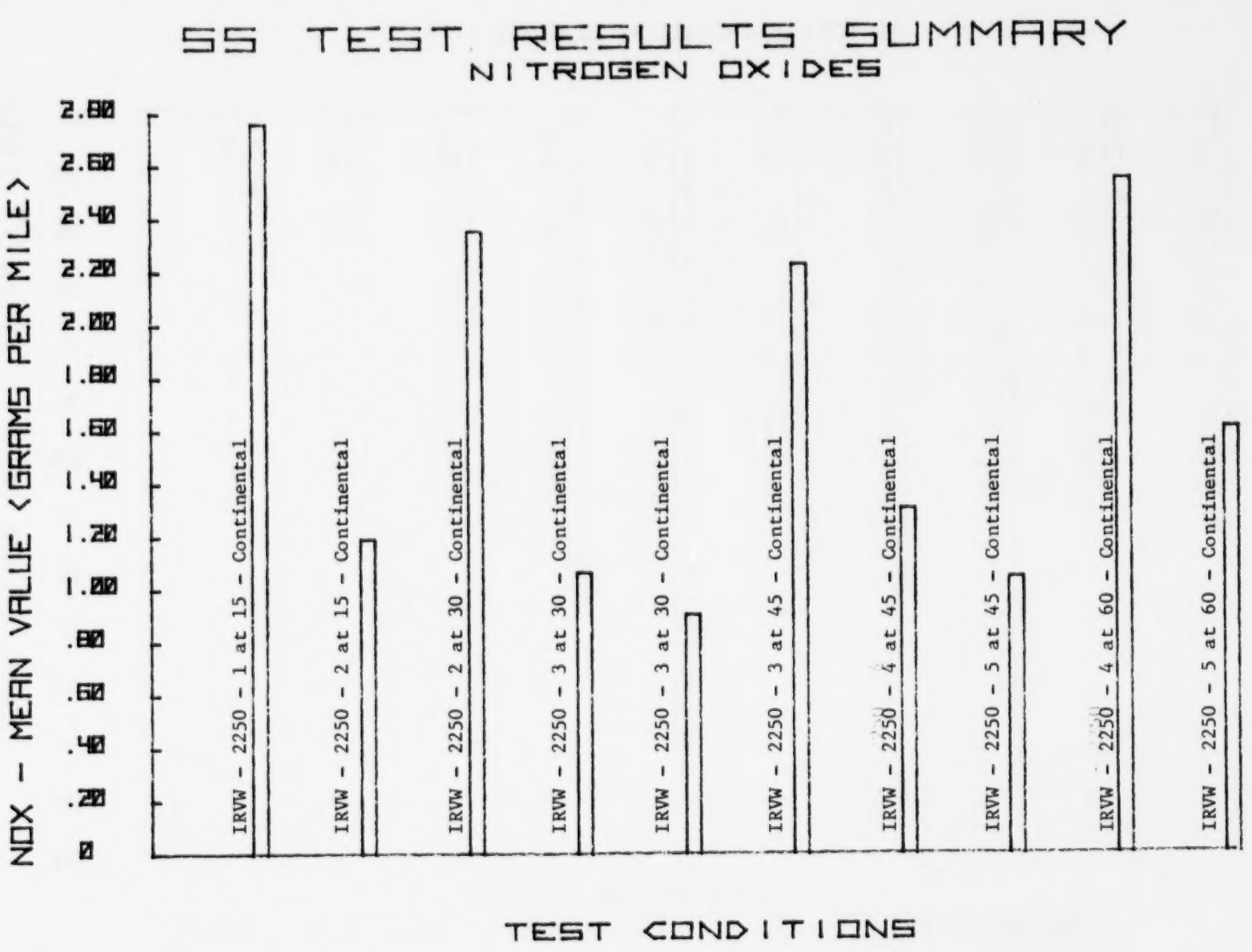

SS TEST RESULTS SUMMARY
CARBONMONOXIDE
CO - MEAN VALUE (GRAMS PER MILE)
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
.75
.50
.25
0
IRVW - 2250 - 1 at 15 - Continental
IRVW - 2250 - 2 at 15 - Continental
IRVW - 2250 - 2 at 30 - Continental
IRVW - 2250 - 3 at 30 - Continental
IRVW - 2250 - 3 at 30 - Continental
IRVW - 2250 - 3 at 45 - Continental
IRVW - 2250 - 4 at 45 - Continental
IRVW - 2250 - 5 at 45 - Continental
IRVW - 2250 - 4 at 60 - Continental
IRVW - 2250 - 5 at 60 - Continental
TEST CONDITIONS

Figure 18

Figure 19


55 TEST RESULTS SUMMARY
NITROGEN OXIDES
NOX - MEAN VALUE <GRAMS PER MILE>
0
.20
.40
.60
.80
1.00
1.20
1.40
1.60
1.80
2.00
2.20
2.40
2.60
2.80
IRVW - 2250 - 1 at 15 - Continental
IRVW - 2250 - 2 at 15 - Continental
IRVW - 2250 - 2 at 30 - Continental
IRVW - 2250 - 3 at 30 - Continental
IRVW - 2250 - 3 at 30 - Continental
IRVW - 2250 - 3 at 45 - Continental
IRVW - 2250 - 4 at 45 - Continental
IRVW - 2250 - 5 at 45 - Continental
IRVW - 2250 - 4 at 60 - Continental
IRVW - 2250 - 5 at 60 - Continental
TEST CONDITIONS

SS TEST RESULTS SUMMARY
FUEL ECONOMY
FUEL ECONOMY - MEAN VALUE (MPG)
TEST CONDITIONS
IRVW - 2250 - 1 at 15 - Continental
IRVW - 2250 - 2 at 15 - Continental
IRVW - 2250 - 2 at 30 - Continental
IRVW - 2250 - 3 at 30 - Continental
IRVW - 2250 - 3 at 30 - Continental
IRVW - 2250 - 3 at 45 - Continental
IRVW - 2250 - 4 at 45 - Continental
IRVW - 2250 - 5 at 45 - Continental
IRVW - 2250 - 4 at 60 - Continental
IRVW - 2250 - 5 at 60 - Continental

Figure 20

Result Summary - Mean (standard deviation)

Table IV: FTP Test Results - (Grams Per Mile)

RPV

Tires	IW	Shift Schedule	Test Phase*	HC-HFID	CO	CO_2	NOx	MPG	Number of Tests
Semperit	2250	Std. (15/25/40)	I	0.48(0.12)	0.93(0.05)	219(7)	0.96(0.04)	45.9(1.5)	7
			III	0.44(0.06)	0.98(0.04)	229(4)	1.22(0.14)	43.9(0.9)	2
		18/30/47	I	0.50	1.00	252	1.24	39.9	1
		18/33/47	III	0.49(0.10)	1.15(.018)	241(18)	1.41(0.28)	41.8(3.1)	4
	2750	Std.	I	0.40(0.08)	0.89(0.06)	236(12)	1.02(0.05)	42.8(2.3)	2
			III	0.34(0.04)	0.94(0.09)	256(12)	1.39(0.06)	39.5(1.8)	2
	3000	Std.	I	0.40	0.82	255	1.08	39.5	1
			III	0.33	0.89	255	1.29	39.5	1
				IRVW					
Continental	2250	9/20/30/40	-	0.25(0.02)	0.69(0.01)	197(2)	1.34(0.02)	51.1(0.5)	3
		11/21/32/42	-	0.11(0.02)	0.57(0.02)	195(3)	0.92(0.03)	51.9(0.9)	6
		13/24/35/46	-	0.12(0.01)	0.66(0.01)	203(3)	1.00(0.01)	49.8(0.7)	2
Prepared Continental		11/21/32/42	-	0.13	0.54	187	0.88	54.1	1
Semperit		9/20/30/40	-	0.23	0.74	200	1.31	50.4	1

Table V: HFET Test Results - (Grams Per Mile)

RPV

Semperit	2250	Std.	I	0.19(0.04)	0.41(0.00)	175(10)	0.88(0.08)	58.0(3.3)	2
		Std.	III	0.32(0.01)	0.72(0.02)	181(3)	1.15(0.05)	55.5(0.8)	3
		18/30/47	I	0.17	0.43	183	0.93	55.3	3
		18/33/47	III	0.33(0.03)	0.76(0.02)	187(3)	1.32(0.10)	53.7(1.0)	3

*Phase 1 - initial test phase, Phase II - smoke problem, Phase III - after rework.

Note: There is no standard deviation for single tests.

Result Summary - Mean (standard deviation)

HFET Test Results - (Grams Per Mile) (cont.)

RPV

Tires	IW	Shift Schedule	Test Phase*	HC-HFID	CO	CO_2	NOx	MPG	Number of Tests
	2750	Std.	I	0.12(0.02)	0.39(0.02)	195(7)	0.97(0.04)	51.9(1.9)	3
			III	0.28(0.04)	0.73(0.04)	208(2)	1.24(0.01)	48.6	2
	3000	Std.	I	0.16	0.44	219	1.08	46.3	1

IRVW

Continental	2250	9/20/30/40	-	0.20(0.02)	0.53(0.02)	161(2)	1.18(0.04)	62.8(0.6)	6
		11/21/32/42	-	0.06(0.01)	0.26(0.02)	159(3)	0.79(0.03)	63.8(1.2)	6
Prepared Continental	2250	11/21/32/42	-	0.06	0.24	149	0.73	68.3	1
		13/24/35/46	-	0.05	0.28	159	0.81	64.0	1
Semperit	2250	9/20/30/40	-	0.18	0.50	161	1.19	62.7	1

Table VI: LA-4 Test Results - (Grams Per Mile)

RPV

Semperit	2250	Std.	I	0.38(0.01	0.85(0.00)	223(4)	1.02(0.05)	45.2(0.8)	2
			III	0.33(0.04)	0.86(0.06)	214(5)	1.26(0.08)	47.1(1.0)	20
		18/33/47	III	0.30	1.39	252	1.60	39.9	1
	2750	Std.	I	0.39	0.83	233	1.00	43.4	1
	3000	Std.	I	0.33	0.80	253	1.11	39.9	1

*Phase I - initial phase, Phase II - smoke problem, Phase III - after rework

Note: There is no standard deviation for single tests.

Result Summary - Mean (standard deviation)

LA-4 Test Results - (Grams Per Mile) (cont.)

IRVW

Tires	IW	Shift Schedule	Test Phase*	HC-HFID	CO	CO_2	NOx	MPG	Number of Tests
Continental	2250	9/20/30/40	-	0.22(0.01)	0.65(0.01)	193(3)	1.35(0.03)	52.2(0.8)	3
		10/23/33/43	-	0.31(0.02)	0.80(0.06)	200(1)	1.41(0.04)	50.4(0.4)	2
	(std.)	11/21/32/42	-	0.24(0.08)	1.02(0.42)	204(6)	0.82(0.11)	49.3(1.7)	3

Table VII: Steady State Test Results - (Grams Per Mile)**

RPV

Tires	IW	Gear at MPH	Test Phase*	HC-HFID	CO	CO_2	NOx	MPG*	Number of Tests
Semperit	2250	idle	I	12.39	26.79	1129	5.30	0.12	1
		1st at 15	I	1.47	2.43	180	0.71	54.7	1
		2nd at 30	I	0.10	0.52	149	0.70	68.0	1
		3rd at 30	I	0.19	0.48	123	0.61	82.3	1
		4th at 45	I	0.09	0.30	147	0.83	69.2	1
		4th at 60	I	0.09	0.42	176	1.17	57.5	1
	2750	idle	I	16.19	29.18	1121	5.40	0.12	1
		idle	III	7.49	17.27	1206	6.90	0.12	1
		1st at 15	I	1.59	2.13	177	0.75	55.7	1
		1st at 15	III	0.97	2.12	329	1.90	30.5	1
		2nd at 15	III	0.39	0.86	186	0.88	54.1	1
		2nd at 30	I	0.11	0.47	354	0.77	28.6	1
		2nd at 30	III	0.55	0.99	231	1.70	43.6	1
		3rd at 30	I	0.19	0.42	124	0.55	81.6	1
		3rd at 30	III	0.19	0.56	159	0.84	63.6	1
		4th at 30	III	0.17	0.29	135	0.65	75.0	1
		4th at 45	I	0.11	0.34	168	0.82	60.2	1
		4th at 45	III	0.19	0.62	179	1.08	56.6	1
		4th at 60	I	0.10	0.41	191	1.20	53.1	1
		4th at 60	III	0.46	0.93	231	1.73	43.6	1

* Note: There is no standard deviation for single tests.
** For idle - grams per hour/gallons per hour.

Steady State Test Results - (Grams Per Mile)**

IRVW

Tires	IW	Gear at MPH	Test Phase	HC-HFID	CO	CO_2	NOx	MPG*	Number of Tests
Continental	2250	idle	-	2.95	12.71	1136	9.06	0.12	2
		1st at 15	-	1.22	3.05	366	2.76	27.3	2
		2nd at 15	-	0.28	0.99	194	1.19	52.0	2
		2nd at 30	-	0.76	1.22	254	2.35	39.7	2
		3rd at 30	-	0.28	0.80	163	1.06	62.0	2
		4th at 30	-	0.13	0.34	134	0.90	75.8	2
		3rd at 45	-	0.86	1.06	208	2.22	48.4	2
		4th at 45	-	0.40	0.86	162	1.30	62.2	2
		5th at 45	-	0.14	0.30	138	1.04	73.3	2
		4th at 60	-	1.26	1.76	211	2.54	47.0	2
		5th at 60	-	0.44	0.96	177	1.60	56.6	2

* Note: There is no standard deviation for single tests.
** For idle - grams per hour/gallons per hour.

Table VIII: Particulate Results - Mean (Standard Deviation) - (Grams Per Mile)

IRVW

Tires	IW	Test Type	Shift Schedule	Particulates	Number of Tests
Continental	2250	FTP	Standard	0.18 (0.01)	4
		HFET	Standard	0.16 (0.02)	3
		SS	3rd at 30 mph	.21	1
		Sulfate	Standard	.18	1

Table IX: Acceleration Time (Seconds)

RPV

Speed in mph	Driver 1[1/]	Driver 2[1/]	Driver 3[2/]	Driver 4[2/]
0-30	5.6	5.2	-	5.5
0-40	7.5	8.1	-	7.2
0-50	11.1	10.7	-	10.5
0-60	15.0	14.8	16.4	15.4
0-70	-	-	-	22.0

1/ Speeds from vehicle speedometer.

2/ Speeds from fifth wheel.

Note: There is no standard deviation for single tests.

Appendix

FTP Composite Mass Emissions (Grams Per Mile)

Semperit Tires

RPV - 2250 lb. Inertia Weight

Test Number	Test Phase	HC-HFID	CO	CO_2	NOx	MPG	Shift Schedule
78-0730	I	0.47	0.88	219	0.94	45.9	Standard (15,25,40)
78-0779	I	0.71	1.03	219	0.89	45.7	Standard
78-0802	I	0.43	0.94	208	0.94	48.3	Standard
78-0816	I	0.34	0.89	213	0.95	47.2	Standard
78-0860	I	0.55	0.95	223	0.97	45.0	Standard
78-0906	I	0.44	0.96	229	1.02	43.9	Standard
78-0939	I	0.41	0.89	223	1.00	45.1	Standard
$\bar{x}$ (∇)		0.48(0.12)	0.93(0.05)	219(7)	0.96(0.04)	45.9(1.5)	-
78-0961	II	0.42	0.97	226	1.18	44.5	Standard
78-3899	III	0.39	1.01	226	1.12	44.5	Standard
78-6050	III	0.48	0.95	232	1.32	43.3	Standard
$\bar{x}$ (∇)		0.44(0.06)	0.98(0.04)	229(4)	1.22(0.14)	43.9(0.9)	-
78-1065	I	0.50	1.00	252	1.24	39.9	18/30/47
78-4562	III	0.40	1.00	225	1.19	44.7	18/33/47
78-4563	III	0.41	0.99	227	1.18	44.3	18/33/47
78-4565	III	0.57	1.30	252	1.51	39.8	18/33/47
78-5179	III	0.57	1.32	260	1.76	38.6	18/33/47
$\bar{x}$ (∇)		0.49(0.10)	1.15(0.18)	241(18)	1.41(0.28)	41.8(3.1)	-

* Phase I - Initial phase, Phase II - Smoke problem, Phase III - After rework.

Appendix

FTP Composite Mass Emissions (Grams Per Mile)

Semperit Tires

RPV - 2750 lb. Inertia Weight

Test Number	Test Phase	HC-HFID	CO	CO_2	NOx	MPG	Shift Schedule
78-0836	I	0.34	0.85	227	0.98	44.4	Standard
78-1015	I	0.45	0.93	244	1.05	41.2	Standard
x (V)		0.40(0.08)	0.89(0.06)	236(12)	1.02(0.05	42.8(2.3)	-
78-3902	III	0.36	1.01	264	1.34	38.2	Standard
78-3907	III	0.31	0.88	247	1.43	40.8	Standard
x (V)		0.34(0.04)	0.94(0.09)	256(12)	1.39(0.06)	39.5(1.8)	-

RPV - 3000 lb. Inertia Weight

78-1016	I	0.40	0.82	255	1.08	39.5	Standard
78-0874	II	0.41	0.99	256	1.28	39.3	Standard
78-3901	III	0.33	0.89	255	1.29	39.5	Standard

* Phase I - Initial phase, Phase II - Smoke problem, Phase III - After rework.

FTP Composite Emissions (Grams Per Mile)

IRVW - 2250 lb. Inertia Weight

Continental Tires

Test Number	HC-HFID	CO	CO_2	NOx	MPG	Shift Schedule
79-0884*	0.12	0.57	198	0.900	51.1	Standard (11/21/32/42)
79-0888*	0.11	0.57	196	0.920	51.6	Standard
79-0891*	0.13	0.55	199	0.970	50.8	Standard
79-1188*	0.08	0.55	190	0.910	53.2	Standard
79-1202	0.09	0.59	194	0.910	52.1	Standard
79-1208	0.12	0.56	192	0.930	52.6	Standard
$\bar{x}$ (∇)	0.11(0.02)	0.57(0.02)	195(3)	0.92(0.03)	51.9(0.9)	-
78-5322	0.26	0.69	199	1.340	50.6	9/20/30/40
78-5334	0.25	0.69	196	1.360	51.4	9/20/30/40
78-5434	0.23	0.68	196	1.310	51.4	9/20/30/40
$\bar{x}$ (∇)	0.25(0.02)	0.69(0.01)	197(2)	1.340(0.02)	51.1 (0.5)	-
79-1211	0.12	0.66	201	1.010	50.3	13/24/35/46
79-1192	0.13	0.67	205	1.000	49.3	13/24/35/46
$\bar{x}$ (∇)	0.12(0.01)	0.66(0.01)	203(3)	1.005(0.01)	49.8(0.7)	-

Lightly Prepared Continental Tires

79-1196	0.130	0.540	187.0	0.880	54.100	11/21/32/42

Sempirit Tires

78-5432	0.230	0.740	200.00	1.310	50.400	9/20/30/40

* Particulate Test.

Bag by Bag Mass Emissions (Grams Per Mile)

Semperit Tires

RPV - 2250 lb. Inertia Weight - Standard Shift Schedule

Test Number	HC	HFID	CO	CO_2	NOx	MPG	HC	HFID	CO	CO_2	NOx	MPG	HC	HFID	CO	CO_2	NOx	MPG
78-0730	0.32	0.69	1.03	237	0.91	42.5	0.24	0.46	0.92	218	0.96	46.2	0.16	0.33	0.68	206	0.93	49.0
78-0779	0.65	1.38	1.34	239	0.84	41.8	0.33	0.61	1.06	217	0.91	46.3	0.21	0.38	0.74	206	0.87	49.0
78-0802	0.28	0.54	0.96	218	0.87	46.2	0.24	0.43	1.05	211	0.98	47.7	0.18	0.32	0.73	197	0.92	51.2
78-0816	0.24	0.43	0.99	229	0.93	44.0	0.20	0.33	0.94	212	0.97	47.5	0.16	0.28	0.70	202	0.93	49.9
78-0860	0.22	0.72	1.05	241	0.95	41.9	0.18	0.58	1.02	221	0.98	45.7	0.13	0.38	0.72	216	0.98	46.8
78-0906	0.22	0.66	1.15	245	0.96	41.1	0.17	0.43	0.99	227	1.04	44.5	0.13	0.31	0.76	220	1.02	45.9
78-0939	0.27	0.53	1.01	248	0.95	40.5	0.20	0.41	0.93	216	1.02	46.6	0.15	0.30	0.74	217	1.01	46.5
78-0961	0.24	0.49	1.13	247	1.16	40.7	0.18	0.42	0.96	225	1.20	44.8	0.18	0.35	0.88	214	1.17	47.2
78-3899	0.28	0.50	1.14	246	1.18	40.9	0.18	0.36	1.02	225	1.13	44.8	0.20	0.36	0.91	212	1.05	47.5
78-6050	0.22	0.54	1.08	255	1.33	39.6	0.16	0.47	0.90	227	1.32	44.4	0.17	0.44	0.95	223	1.30	45.1
RPV - 2250 lb. Inertia Weight - Shift Schedule (18/30/47)																		
78-1065	0.29	0.59	1.07	251	1.08	40.1	0.25	0.54	1.08	265	1.37	38.0	0.18	0.35	0.50	141	0.70	44.6
RPV - 2250 lb. Inertia Weight - Shift Schedule (18/33/47)																		
78-4562	0.25	0.49	1.12	246	1.24	41.0	0.18	0.40	0.98	222	1.17	45.4	0.21	0.34	0.95	216	1.20	46.7
78-4563	0.25	0.51	1.13	248	1.23	40.5	0.17	0.39	0.94	221	1.17	45.6	0.21	0.37	0.97	220	1.17	45.8
78-4565	0.29	0.56	1.31	264	1.41	38.1	0.30	0.64	1.37	257	1.61	39.1	0.27	0.46	1.16	232	1.40	43.4
78-5179	0.66	0.55	1.38	269	1.64	37.2	0.75	0.62	1.40	271	1.92	36.9	0.58	0.48	1.12	232	1.54	43.1
RPV - 2750 lb. Inertia Weight - Standard Shift Schedule																		
78-0836	0.21	0.43	0.93	241	0.95	41.9	0.18	0.35	0.91	222	0.99	45.2	0.14	0.27	0.67	226	0.97	44.8
78-1015	0.28	0.55	1.04	270	1.05	37.4	0.24	0.48	0.97	238	1.06	42.4	0.18	0.34	0.75	237	1.03	42.6
78-3902	0.27	0.47	1.20	292	1.34	34.6	0.19	0.34	0.95	255	1.34	39.5	0.22	0.34	0.96	260	1.32	38.8
78-3907	0.22	0.39	1.00	267	1.34	37.6	0.15	0.28	0.82	243	1.56	41.6	0.18	0.31	0.89	239	1.23	42.2
RPV - 3000 lb. Inertia Weight - Standard Shift Schedule																		
78-1016	0.22	0.48	0.93	284	1.09	35.6	0.21	0.41	0.85	249	1.09	40.6	0.15	0.31	0.67	246	1.05	41.1
78-0874	0.25	0.51	1.15	282	1.25	35.8	0.16	0.40	0.94	248	1.30	40.6	0.19	0.34	0.96	252	1.27	40.1
78-3901	0.24	0.42	1.08	281	1.28	35.9	0.16	0.31	0.83	247	1.32	40.9	0.18	0.32	0.86	249	1.26	40.5

Bag by Bag Mass Emissions (Grams Per Mile)

Continental Tires

IRVW - 2250 lb. Inertia Weight - Standard Shift Schedule

Test Number	HC	HFID	CO	CO_2	NOx	MPG	HC	HFID	CO	CO_2	NOx	MPG	HC	HFID	CO	CO_2	NOx	MPG
79-0884*	0.08	0.12	0.68	212	0.87	47.7	0.06	0.15	0.62	197	0.95	51.3	0.05	0.05	0.41	189	0.83	53.7
79-0888*	0.08	0.18	0.68	208	0.87	48.6	0.07	0.10	0.62	195	0.96	51.9	0.04	0.08	0.42	188	0.88	53.9
79-0891*	0.06	0.17	0.62	210	0.92	48.3	0.60	0.13	0.59	198	1.02	51.1	0.04	0.11	0.44	193	0.92	52.6
79-1188*	0.06	0.10	0.62	191	0.83	52.9	0.06	0.08	0.60	193	0.96	52.5	0.04	0.07	0.43	184	0.87	55.0
79-1202	0.08	0.12	0.67	203	0.85	49.8	0.06	0.09	0.65	192	0.95	52.7	0.04	0.07	0.43	190	0.89	53.4
79-1208	0.07	0.13	0.68	209	0.90	48.5	0.06	0.12	0.58	187	0.95	54.0	0.05	0.10	0.44	187	0.91	54.1

IRVW - 2250 lb. Inertia Weight - Standard Shift Schedule (9/20/30/40)

78-5322	0.15	0.28	0.77	211	1.28	47.8	0.12	0.26	0.72	200	1.41	50.6	0.10	0.24	0.56	190	1.26	53.2
78-5334	0.14	0.31	0.81	207	1.24	48.7	0.10	0.23	0.70	196	1.43	51.4	0.10	0.24	0.56	188	1.29	53.7
78-5434	0.14	0.26	0.76	209	1.20	48.4	0.11	0.24	0.70	196	1.36	51.5	0.10	0.20	0.57	186	1.30	54.4

IRVW - 2250 lb. Inertia Weight - Standard Shift Schedule (13/24/35/46)

79-1211	0.09	0.11	0.75	214	0.91	47.2	0.08	0.13	0.72	200	1.08	50.5	0.06	0.12	0.49	194	0.95	52.2
79-1192	0.08	0.13	0.77	217	0.92	46.6	0.07	0.14	0.72	207	1.08	48.8	0.06	0.12	0.50	192	0.93	52.7

Lightly Prepared Continental Tires

IRVW - 2250 lb. Inertia Weight - Standard Shift Schedule (11/21/32/42)

79-1196	0.08	0.17	0.67	209	0.87	48.3	0.05	0.14	0.55	179	0.88	56.5	0.04	0.09	0.41	186	0.88	54.4

Semperit Tires - Shift Schedule (9/20/30/40)

78-5432	0.14	0.28	0.86	212	1.23	47.6	0.12	0.23	0.77	200	1.37	50.5	0.10	0.20	0.61	192	1.25	52.6

* First three bags of four bag particulate FTP.

HFET Mass Emissions (Grams Per Mile)

Semperit Tires

RPV - 2250 lb. Inertia Weight

Test Number	Test Phase	HC	HFID	CO	CO_2	NOx	MPG	Shift Schedule
78-0731	I	0.11	0.21	0.41	168	0.82	60.3	Standard (15/25/40)
78-0861	I	0.06	0.16	0.41	182	0.93	55.6	Standard
$\bar{x}$ (V)		0.09(0.04)	0.19(0.04)	0.41(0.00)	175(10)	0.88(0.08)	58.0(3.3)	-
78-0962	II	0.16	0.27	0.67	182	1.20	55.4	Standard
78-3900	III	0.19	0.32	0.70	179	1.12	56.2	Standard
78-4561	III	0.19	0.32	0.74	185	1.21	54.6	Standard
78-4564	III	0.19	0.33	0.73	180	1.12	55.8	Standard
$\bar{x}$ (V)		0.19(0.0)	0.32(0.01)	0.72(0.02)	181(3)	1.15(0.05)	55.5(0.08)	-
78-1066	I	0.88	0.17	0.43	183	0.93	55.3	18/30/47
78-4566	III	0.18	0.33	0.75	184	1.22	54.8	18/33/47
78-1034	III	0.19	0.35	0.78	189	1.31	53.2	18/33/47
78-5180	III	0.39	0.30	0.74	189	1.42	53.0	18/33/47
$\bar{x}$ (V)		0.25(0.12)	0.33(0.03)	0.76(0.02)	187(3)	1.32(0.10)	53.7(1.0)	-

RPV - 2750 lb. Inertia Weight

78-0837	I	0.07	0.11	0.38	193	0.98	52.4	Standard
78-0838	I	0.08	0.12	0.38	190	0.93	53.4	Standard
78-1017	I	0.07	0.14	0.42	203	1.01	49.8	Standard
$\bar{x}$ (V)		0.07(0.01)	0.12(0.02)	0.39(0.02)	195(7)	0.97(0.04)	51.9(1.9)	-
78-3903	III	0.21	0.31	0.76	209	1.24	48.3	Standard
78-3908	III	0.16	0.25	0.70	206	1.23	48.9	Standard
$\bar{x}$ (V)		0.19(0.04)	0.28(0.04)	0.73(0.04)	208(2)	1.24(0.01)	48.6(0.4)	

* Phase I - initial phase, Phase II - smoke problem, Phase III - after rework

HFET Mass Emissions (Grams Per Mile)

Semperit Tires

RPV - 3000 lb. Inertia Weight

Test Number	Test Phase	HC	HFID	CO	CO_2	NOx	MPG	Shift Schedule
78-1033	I	0.08	0.16	0.44	219	1.08	46.3	Standard
78-0875	II	0.20	0.34	0.80	217	1.34	46.5	Standard
78-0940	II	0.19	0.30	0.80	209	1.32	48.3	Standard
$\bar{x}$ (∇)		0.20(0.01)	0.32(0.03)	0.80(0.0)	213(6)	1.33(0.01)	47.4(1.3)	-

Continental Tires

IRVW - 2250 lb. Inertia Weight

79-0886**	-	0.03	0.08	0.27	161	0.73	62.9	Std.(11/21/32/42)
79-1190**	-	0.03	0.06	0.27	159	0.82	64.0	11/21/32/42
79-1209	-	0.02	0.04	0.26	159	0.78	63.7	11/21/32/42
79-1200	-	0.02	0.05	0.26	161	0.81	63.0	11/21/32/42
79-1191	-	0.03	0.07	0.27	160	0.82	63.2	11/21/32/42
79-1194	-	0.02	0.07	0.26	153	0.78	66.2	11/21/32/42
$\bar{x}$ (∇)		0.02(0.01)	0.06(0.02)	0.26(0.01)	159(3)	0.79(0.03)	63.8(1.2)	-
78-5323	-	0.11	0.23	0.53	162	1.19	62.2	9/20/30/40
78-5313	-	0.10	0.21	0.55	163	1.17	62.1	9/20/30/40
78-5333	-	0.09	0.18	0.50	161	1.19	62.7	9/20/30/40
78-5335	-	0.10	0.20	0.53	159	1.15	63.4	9/20/30/40
78-5336	-	0.10	0.19	0.53	162	1.14	62.5	9/20/30/40
78-5435	-	0.10	0.20	0.52	159	1.25	63.7	9/20/30/40
$\bar{x}$ (∇)		0.10(0.01)	0.202(0.02)	0.527(0.02)	161(2)	1.182(0.04)	62.8(0.06	-
79-1201	-	0.02	0.06	0.26	155	0.77	65.5	13/24/35/46
79-1210	-	0.02	0.06	0.25	154	0.75	66.0	13/24/35/46
79-1212	-	0.03	0.07	0.26	154	0.79	65.8	13/24/35/46
79-1193	-	0.03	0.07	0.28	161	0.83	62.8	13/24/35/46
$\bar{x}$ (∇)		0.02(0.01)	0.06(0.01)	0.26(0.01)	156(3)	0.78(0.03)	65.0(1.5)	-

* Phase I - initial phase, Phase II - smoke problem, Phase III - smoke problem

** Particulate test

HFET Mass Emissions (Grams Per Mile)

IRVW - 2250 lb. Inertia Weight

Lightly Prepared Continental Tires

Test Number	Test Phase	HC	HFID	CO	CO_2	NOx	MPG	Shift Schedule
79-1197	-	0.02	0.06	0.24	149	0.73	68.3	11/21/32/42
79-1198	-	0.02	0.05	0.28	159	0.81	64.0	13/24/35/46
Semperit Tires								
78-5433	-	0.09	0.18	0.50	161	1.19	62.7	9/20/30/40

LA-4 Composite Mass Emissions (Grams Per Mile)

Semperit Tires

RPV - 2250 lb. Inertia Weight

Test Number	Test Phase*	HC-HFID	CO	CO_2	NOx	MPG	Shift Schedule
78-0987	I	0.39	0.85	226	1.05	44.6	Standard
78-0988	I	0.37	0.85	220	0.98	45.7	Standard
$\bar{x}$ (V)		0.38(0.01)	0.85(0.00)	223(4)	1.02(0.05)	45.2(0.8)	-
78-5676	III	0.34	0.90	212	1.26	47.4	Standard
78-5677	III	0.32	0.90	216	1.25	46.6	Standard
78-5681	III	0.38	0.80	212	1.24	47.4	Standard
78-5682	III	0.39	0.80	212	1.26	47.4	Standard
78-5683	III	0.40	0.90	215	1.26	46.7	Standard
78-5679	III	0.31	0.80	218	1.20	46.2	Standard
78-5680	III	0.33	0.80	219	1.22	46.0	Standard
78-5678	III	0.35	0.80	218	1.22	46.2	Standard
78-5947**	III	0.27	0.80	203	1.20	49.6	Standard
78-5945**	III	0.29	0.80	207	1.22	48.6	Standard
78-5944**	III	0.33	0.80	208	1.21	48.4	Standard
78-5946**	III	0.35	0.80	211	1.20	47.7	Standard
78-6049**	III	0.35	0.90	222	1.28	45.3	Standard
78-6285	III	0.39	1.00	210	1.30	47.8	Standard
78-6286	III	0.28	0.90	216	1.46	46.6	Standard
78-6287	III	0.30	0.90	218	1.41	46.2	Standard
78-6288	III	0.29	0.90	214	1.43	47.0	Standard
78-6284	III	0.30	0.90	213	1.19	47.2	Standard
78-6283	III	0.36	0.90	216	1.20	46.6	Standard
78-6282	III	0.33	0.90	213	1.20	47.2	Standard
$\bar{x}$ (V)		0.33(0.04)	0.86(0.06)	214(5)	1.26(0.08)	47.1(1.0)	-
78-4567	-	0.30	1.39	252	1.60	39.9	Standard
			RPV - 2750 lb. Inertia Weight				
78-1019	-	0.39	0.83	233	1.00	43.4	Standard
			RPV - 3000 lb. Inertia Weight				
78-1031	-	0.33	0.80	253	1.11	39.9	Standard

* Phase I - initial tes phase, Phase II - smoke problem, Phase III - after rework
** Line preheated to 400°F skin temperature

LA-4 Composite Mass Emissions (Grams Per Mile)

Continental Tires

IRVW - 2250 lb. Inertia Weight

Test Number	HC-HFID	CO	CO_2	NOx	MPG	Shift Schedule
78-5310	0.28*	1.28	208	0.73	48.2	Standard(11/21/32/42)
78-5311	0.28*	1.25	207	0.79	48.5	11/21/32/42
79-1199	0.150	0.54	197	0.94	51.3	11/21/32/42
$\bar{x}$ (∇)	0.24(0.08)	1.02(0.42)	204(6)	0.82(0.11)	49.3(1.7)	-
78-5312	0.23	0.64	192	1.37	52.5	9/20/30/40
78-5337	0.22	0.65	197	1.32	51.2	9/20/30/40
78-5333	0.22	0.65	191	1.35	52.8	9/20/30/40
$\bar{x}$ (∇)	0.22(0.01)	0.65(0.01)	193(3)	1.35(0.03)	52.2(0.08)	-
78-5331	0.32	0.84	201	1.43	50.1	10/23/33/43
78-5427	0.29	0.75	199	1.38	50.6	10/23/33/43
$\bar{x}$ (∇)	0.31(0.02)	0.80(0.06)	200(1)	1.41(0.04)	50.4(0.4)	-

* HC-FID only.

Steady State Composite Mass Emissions (grams per mile)*

Semperit Tires

RPV - 2250 lb. Inertia Weight

Test No.	Test Phase	HC	HFID	CO	CO_2	NOx	MPG*	Gear @ MPH
78-0804	I	6.50	12.39	26.79	1129	5.30	0.12	idle
78-1018	II	2.95	7.03	15.23	1177	7.09	0.12	idle
78-0804	I	0.65	1.47	2.43	180	0.71	54.7	1st @ 15
78-1018	II	0.51	1.03	2.23	333	1.99	30.1	1st @ 15
78-1018	II	0.10	0.27	0.82	185	0.96	54.7	2nd @ 15
78-0804	I	0.06	0.10	0.52	149	0.70	68.0	2nd @ 30
78-1020	II	0.23	0.45	1.07	231	1.60	43.7	2nd @ 30
78-0805	I	0.10	0.19	0.48	123	0.61	82.3	3rd @ 30
78-1020	II	0.10	0.18	0.62	160	0.89	63.3	3rd @ 30
78-1020	II	0.04	0.09	0.27	137	0.72	73.8	4th @ 30
78-0805	I	0.06	0.09	0.30	147	0.83	69.2	4th @ 45
78-1032	II	0.09	0.13	0.53	163	1.05	62.0	4th @ 45
78-0805	I	0.06	0.09	0.42	176	1.17	57.5	4th @ 60
78-1032	II	0.16	0.26	0.76	199	1.64	50.7	4th @ 60

RPV - 2750 lb. Inertia Weight

78-0839	I	7.39	16.19	29.18	1121	5.40	0.12	idle
78-3904	III	3.68	7.49	17.27	1206	6.90	0.12	idle
78-0839	I	0.67	1.59	2.13	177	0.75	55.7	1st @ 15
78-3904	III	0.54	0.97	2.12	329	1.90	30.5	1st @ 15
78-3904	III	0.16	0.39	0.86	186	0.88	54.1	2nd @ 15
78-0839	I	0.09	0.11	0.47	354	0.77	28.6	2nd @ 30
78-3905	III	0.28	0.55	0.99	231	1.70	43.6	2nd @ 30
78-0840	I	0.09	0.19	0.42	124	0.55	81.6	3rd @ 30
78-3905	III	0.09	0.19	0.56	159	0.84	63.6	3rd @ 30
78-3905	III	0.05	0.17	0.29	135	0.65	75.0	4th @ 30
78-0840	I	0.07	0.11	0.34	168	0.82	60.2	4th @ 45
78-3906	III	0.11	0.19	0.62	179	1.08	56.6	4th @ 45
78-0840	I	0.06	0.10	0.41	191	1.20	53.1	4th @ 60
78-3906	III	0.25	0.46	0.93	231	1.73	43.6	4th @ 60

RPV - 3000 lb. Inertia Weight

78-0907	II	3.57	8.86	17.01	1201	7.08	0.12	idle
78-0907	II	0.50	1.03	2.14	325	2.02	30.8	1st @ 15
78-0907	II	0.12	0.27	0.88	186	1.00	54.2	2nd @ 15
78-0908	II	0.32	0.65	0.96	239	1.88	42.0	2nd @ 30
78-0908	II	0.10	0.21	0.52	175	0.93	57.8	3rd @ 30
78-0908	II	0.06	0.17	0.27	155	0.76	65.3	4th @ 30
78-0909	II	0.10	0.17	0.54	183	1.09	55.4	4th @ 45
78-0909	II	0.42	0.66	1.19	240	1.74	41.9	4th @ 60

* Phase I - initial testing, Phase II - smoke problem, Phase III - after rework
* For idle - grams per hour/gallons per hour

IRVW - 2250 lb. Inertia Weight, Continental Tires

Test No.	HC	HFID	CO	CO_2	NOx	MPG (GPH for idle)	Gear @ MPH
78-5330	1.29	3.41	13.37	1153	8.94	0.12	idle
78-5428	1.46	2.48	12.05	1120	9.18	0.11	idle
78-5330	0.41	1.26	3.21	364	2.71	27.5	1st @ 15
78-5428	0.36	1.17	2.89	369	2.80	27.1	1st @ 15
78-5330	0.10	0.26	1.00	194	1.20	51.9	2nd @ 15
78-5428	0.11	0.29	0.98	193	1.18	52.2	2nd @ 15
78-5328	0.20	0.88	1.24	257	2.44	39.2	2nd @ 30
78-5429	0.16	0.65	1.20	251	2.26	40.2	2nd @ 30
78-5328	0.11	0.26	0.83	168	1.10	59.9	3rd @ 30
78-5429	0.11	0.29	0.76	158	1.01	64.0	3rd @ 30
78-5328	0.04	0.13	0.32	141	0.98	71.9	4th @ 30
78-5429	0.05	0.13	0.35	127	0.82	79.6	4th @ 30
78-5329	0.27	0.75	0.97	207	2.26	48.6	3rd @ 45
78-5430	0.33	0.97	1.16	208	2.18	48.1	3rd @ 45
78-5329	0.18	0.39	0.86	161	1.36	62.4	4th @ 45
78-5430	0.16	0.42	0.86	162	1.24	62.1	4th @ 45
78-5329	0.05	0.14	0.30	137	1.06	73.7	5th @ 45
78-5430	0.04	0.15	0.31	139	1.01	72.9	5th @ 45
78-5332	0.73	1.38	1.80	213	2.61	46.5	4th @ 60
78-5431	0.58	1.13	1.72	209	2.50	47.6	4th @ 60
78-5332	0.22	0.47	1.04	178	1.58	56.3	5th @ 60
78-5431	0.21	0.42	0.88	176	1.61	57.0	5th @ 60

Acceleration Time

Research Prototype Vehicle

Speed in mph	Driver 1[1/]	Driver 2[1/]	Driver 3[2/]	Driver 4[2/]
0-30	5.8/5.5	5.2		5.6/5.4
0-40	7.4/7.6	8.1		7.2/7.2
0-50	11.0/11.2	10.8/10.9/10.4		10.4/10.6
0-60	15.8/15.6/15/13.9/14.7/14.8	14.4/15.2	16.8/16.8/15.6	15.4/15.3
0-70				22./22.1

1/ Speeds from vehicle speedometer.
2/ Speeds from fifth wheel.

Speedometer Calibration (Miles Per Hour)

Research Prototype Vehicle

Speedometer	Fifth Wheel
30	25
40	35
50	45
60	55
70	65
80	75

Shift Points

Research Prototype Vehicle

Driver	Acceleration	Shift from-to		
		1-2	2-3	3-4
#1[1/]	Easy	20	30	44
		20	34	46
		19	33	44
	Moderate	23	38	51
	Hard	26	45	65
#3[2/]		24	40	62
		22	38.5	58
		22	41	61
		23	41	61

1/ Speeds from vehicle speedometer.
2/ Speeds from fifth wheel.

B910
9

Particulate Mass Emissions (Grams Per Mile)

Continental Tires

IRVW - 2250 lb. Inertia Weight

Test Number	Test Type	Particulates	Shift Schedule
79-0884	FTP	0.163	Standard
79-0888	FTP	0.169	Standard
79-0891	FTP	0.195	Standard
79-1188	FTP	0.179	Standard
$\bar{x}$ (∇)		0.177(0.014)	
79-0886	HFET	0.179	Standard
79-1190	HFET	0.145	Standard
$\bar{x}$ (∇)		0.162(0.024)	
79-0890	SS-3rd at 30 mph	0.209	3rd at 30
79-0893	Sulfate Cycle	0.164	Standard
79-0887	Sulfate Cycle	0.175	Standard
$\bar{x}$ (∇)		0.170(0.008)	

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979- 651-112/0126